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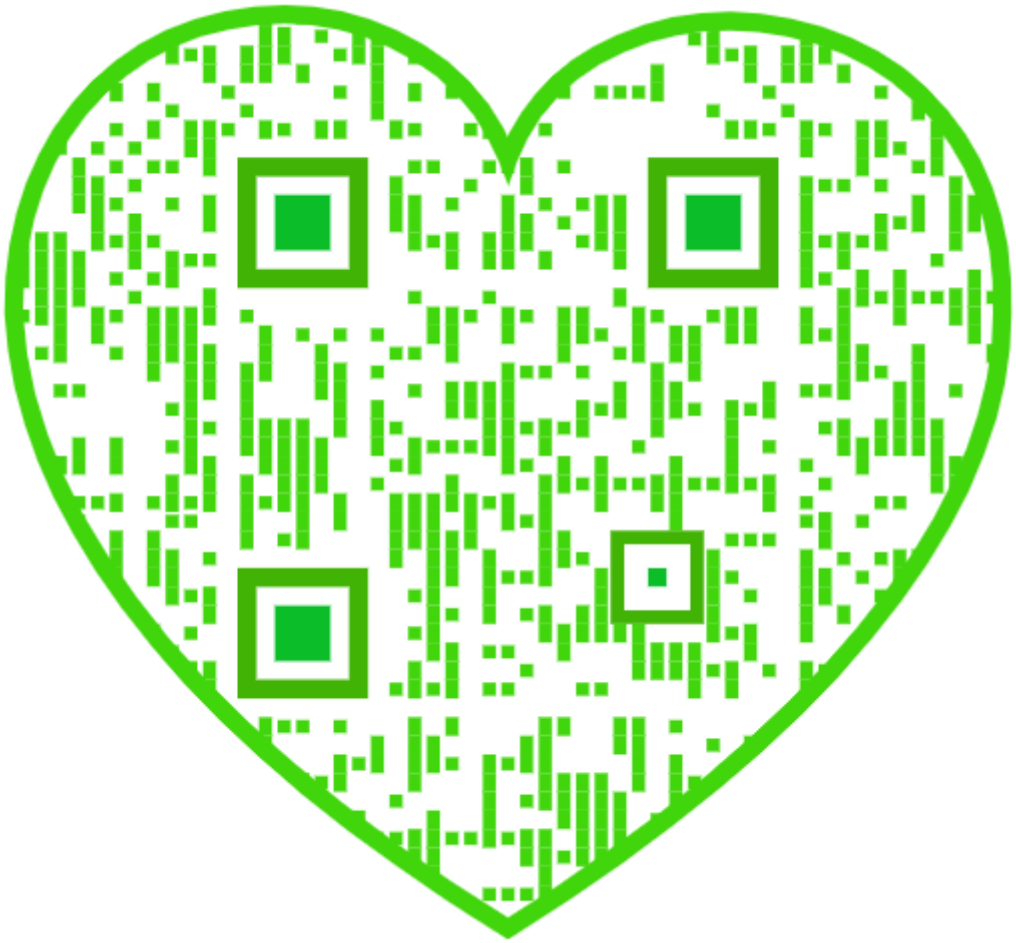

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, FEBRUARY 7, 1903.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SIGNING OF THE PANAMA CANAL TREATY.

That great national work, the Panama Canal, has moved another important step forward by the signing of the treaty between the United States and Colombia, providing for the construction of the canal by this government. The event will cause the greater satisfaction because of the apparently unalterable position taken by the Colombian government through its representative, in demanding an exorbitant price for the concession of the six-mile strip along the route of the canal. There is some talk of opposition in the Senate to the ratification of the treaty; but in view of the clearly-expressed will of the people of the United States to have the Panama Canal built, we do not apprehend that any considerable portion of our Senators will be so fatuous as to oppose the signing of the treaty. It is pretty safe to say that long before the canal is completed, this country will have very great need for this short cut from the Atlantic to the Pacific seaports, particularly if complications over some future Venezuelan or similar incident should fail of such easy adjustment as the present trouble in South America.

EXPLOSION OF A 12-INCH GUN AT SANDY HOOK.

The premature detonation of a high-explosive shell at Sandy Hook has completely wrecked a 12-inch army gun, valued at about $50,000, and has served, incidentally, to shatter the expectations which had been based on a new form of high-explosive, and a new type of high-explosive shell. We say "new," although as a matter of fact both shell and explosive have been before the public for several years, and have received considerable notoriety because of a generous appropriation granted by Congress for the purpose of testing them. The high explosive was very much behind the times, because in comparison with the army explosive shell-filler it was over-sensitive to shock, while the shell was equally out of date, by virtue of the fact that it aimed to prevent detonation from shock, by dividing the shell internally into a number of cellular chambers, each containing its share of explosive. Even had the shell and its filler proved successful in these tests, there would still have been no call for them in army service, for the reason that in Maximite and Dunnite the army has secured a high explosive which, combined with absolute insensitiveness to shock, gives most terrific bursting effects, as was shown two years ago at the Proving Ground, when a 12-inch Krupp plate was perforated and the backing completely wrecked. Maximite and Dunnite require no special construction of the interior of the shell, since they possess in a high degree the insensitivenes which is indispensable in a satisfactory shell filler.

Both the shell and the explosive which caused the wreck of the army gun at Sandy Hook were condemned by ordnance experts before Congress made a lavish appropriation for the purpose of testing them; and herein we see another of those costly lessons (the damages in the present case amounting, as we have said, to some $50,000) as to the folly of Congress in rejecting the opinions of the very ordnance experts upon whose judgment it is supposed to rely. There are a multitude of technical questions in which the average layman, in the very nature of things, is at best but slightly instructed; and when appropriations are asked for the purpose of testing experimental devices of a complicated or highly technical kind, it would be well to let the word of the ordnance officers be final as to whether the device is worthy the expense (usually very great) of a proving ground trial.

SHIPBUILDING DURING 1902.

The returns of shipbuilding that are available for the year 1902 prove that although it has been a busy season among all the shipyards of the world, it does not reach in total output the figures of the year preceding. During 1902, 2,393 vessels of a total tonnage of 2,699,000 tons were launched, whereas in 1901, 2,192 vessels of 2,763,000 tons were launched, an increase in the number of vessels, but a decrease in the total tonnage of 64,000 tons. As usual, considerably more than half, in fact sixty per cent, of the world's output was built in British shipyards, from which, during the year, was launched a total of 1,368 vessels of 1,619,000 total tonnage. Next to Great Britain in amount of construction came the United States and Germany. There were launched in this country in 1902, 162 vessels of 315,000 tons, which is a decrease of 10,000 tons compared with the previous year. Germany launched 259 vessels of 272,000 tons, an increase during the year of 6,000 tons.

The prosperity of the shipping trade has been practically world-wide, the tonnage launched in France having risen from 32 vessels of 86,000 tons in 1901, to 102 vessels of 190,000 tons in 1902. Italy, Japan, and Holland all show a considerable increase. There is not much to be said regarding the character of the ships that were built, for there have been no radical changes either in form of hull or in motive power. Perhaps the most interesting feature of the statistics is the increase in the number of sailing ships, the proportion of sailing to steam tonnage built in British yards having risen from 2.2 per cent in 1900 to 3.9 per cent in 1901, and 5.6 per cent in 1902. Unquestionably the most interesting sailing ship of the year was the seven-masted schooner "Thomas W. Lawson." The steam turbine is not making the rapid advance in the mercantile marine that was expected, although it is being applied to a few passenger steamers and steam yachts. The most interesting steamship of the year was, of course, the new North German Lloyd liner "Kaiser Wilhelm II.," of 26,000 tons displacement and 24 knots speed.

"AMERICA" CUP CONTEST.

There are certain facts connected with the 1903 series of contests for the "America" cup that will render the coming season particularly interesting. Hitherto it has been so much a matter of settled conviction with the majority of the American people that the defending yacht cannot be beaten, that the existence, as in the present case, of any conditions favorable to the English boat, are welcomed as rendering the contest a closer one and, therefore, introducing that element of uncertainty as to the result which is the very soul of all true sport. Gradually the competing yachts have been drawing closer together in speed; and the increase has been, of late years, more rapid in the English than in the American yacht. This is shown by the fact that in 1901 Herreshoff failed to produce in "Constitution" a faster yacht than the two-year old "Columbia;" whereas "Shamrock II." pushed the American boat so closely at times that the more the observer knew about yachting, the more doubtful did he feel as to the final issue. On this side of the water Herreshoff is engaged in a second attempt to improve upon "Columbia," and whether he will do so or not, is just as much a matter of uncertainty as was the ultimate victory of "Constitution." There is a popular rumor abroad, which is shared, by the way, by many yachtsmen, that the latter boat has never shown her best speed. Why, we could never understand. She was in charge of one of our most skilled amateur yachtsmen, who had won golden opinions in the previous series of contests by the way in which he handled "Defender" against "Columbia." And as to the sailors on "Constitution," were they not all American seamen, selected in obedience to the popular wish that the American-built yacht should have an American-born crew from skipper to cook? Hence, if "Constitution" failed of selection to defend the cup, the fault must surely have been more in herself than in those who had charge of her. However, this is a moot question that will lend special zest to the trial races of the season, quite apart from the fact that the new cutter now in course of construction will come to the line prepared to show that what "Constitution" can do to "Columbia," she in turn can do to "Constitution." But what a sensation if the four-year-old boat, under her brand-new suit of canvas, should steal home, once more a winner, with the few necessary seconds to spare!

So much for this side of the water. In England, we only know that another costly cutter is being built, this time from designs by Fife, the designer of "Shamrock I." It is stated, probably with truth, that Watson, who designed "Shamrock II.," has collaborated with Fife to the extent of giving him the benefit of his experience. The third "Shamrock" is being built in the same yard as her predecessor; and although there have been rumors of radical changes in material and model, we shall be greatly surprised if the new challenger turns out to vary in any but a few minor details of form, construction, and sail plan, from the boat of 1901. There is one fact, however, that should put the challenging boat in a very much better position for a cup contest than any before her, and this is that she is so far advanced that probably she will be launched some time in March, and therefore ahead of the American yacht. This has never happened before, and it means that the English boat, if she is properly managed and handled, will receive a very thorough tuning up before the contests of August. The present programme is to try her on the Clyde in actual races sailed for prizes against "Shamrock I.," a vessel of pretty well-known speed and capabilities. She is then to be sent over here and tested outside Sandy Hook against "Shamrock II.," whose speed will give, by way of "Columbia," an excellent line on the respective merits of the challenging and defending yachts. Except for purposes of exhibition, it would seem to be a mistake, however, to try out the new boat in British waters. It would be better as soon as she is launched to ship her spars, sails, etc., to this side, bring the boat over, rig her, anchor her inside Sandy Hook and try her every day in every kind of weather over the New York Yacht Club's course. A single day's sailing under cup conditions outside the Hook is worth a whole week's drifting on the Clyde or in the Solent. The year 1903 gives promise of being the most notable yachting season since the memorable time when "Colonia," "Vigilant," "Jubilee," and "Pilgrim" were launched for the purpose of cup defense.

THE DISEASES OF DUST.

The recent experiments in this country and Europe with the disease germs collected on gelatine plates from the dust of city streets demonstrate almost to a certainty that our municipal health would be greatly improved if there were some simple method provided to keep the dust from entering our homes and lungs. The tests made with the germs thus collected indicate that people in large cities are practically living directly over a "Cave of Furies," and that all around exist the bacteria and microbes of a score or more of dangerous diseases. If this dust remained spread over the streets of the city, it would do little harm; but every wind blows it around, and every street cleaner sweeps up enough of it to destroy a whole houseful of people. There is something insidiously dangerous in the street sweeper's broom. Death actually lurks therein far more than in the filthy corners of the streets left untouched by broom or wind. Sunshine destroys more disease germs than any other agency of nature, and when the direct rays of the sun can penetrate to the heap of filth and dirt the destruction is great. The street sweeper's work of stirring up the disease germs of the avenues is consequently partly checked in its direful results by the action of the sun's rays, which have a better opportunity to reach the floating particles of dust than when they are covering the streets in thick layers. But the dust disturbed by the broom in dark streets and alleys is not thus purified. The experts appointed by the Paris Medical Society to investigate the subject of street dust in its relationship to diseases and their spread, reported recently that the only safe way to cleanse the public thoroughfares was to flush them with water. One good hydrant, with a fair pressure of water, would do more toward cleaning the streets than half a hundred sweepers. The latter would merely collect the coarse and more visible pieces of dirt and cart them away, while the fine, impalpable dust which contained the disease germs would be left floating around in the air or distributed in our open windows. Flushing the streets with a good force of water would carry the germs away through the sewers, and in the case of consumptive germs they would be effectually prevented from rising into the upper air for the people to breathe. A pile of filth may reek with poisonous disease germs, and yet if kept moist the danger to those living nearby may be comparatively small. When the dry, warm weather comes, however, the germs are separated from their environments and float in the air.

One of the most satisfactory solutions to the dust problem comes from Germany, where a number of chemists have been making extensive experiments with the germs collected from the dust of Berlin and Vienna. By sprinkling chemicals of a powerful nature in the streets once a week, or once every fortnight, all disease germs are destroyed. These chemical disinfectants of the streets, or as they might more properly be called, insecticides, are prepared for ordinary disease germs that are found in the dust of streets, but there are other mixtures suited to specially virulent disease germs that may occasionally find their way into particular streets or cities. In this way it is supposed that there would be little danger of the diseases spreading further by means of the dust. There is every reason to believe that in many of our disease epidemics the dust-laden wind has been an effective agent in carrying them from one street or town to another. Sometimes the clouds of dust have been blown several hundred feet away, and small particles in the

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upper air have floated around for days before finally dropping to the earth again. In the upper currents of air they might travel a hundred miles before descending low enough to be breathed in by people. It has been estimated by German experts, who have made more of a study of these questions than any other nationality, that tropical diseases have in this way been carried by the wind from the mainland to islands ten miles and more in distance. Heretofore it has been said that tropical diseases were more or less local, and that the germs rarely reached an altitude of a few feet. But this must be modified in the case of germs which are carried upward by means of fine dust. While not volatile enough to float to any great distance in the air, they might easily be carried up there by the wind, and then distributed around over a wide area before falling. The germs which are destroyed by the warm rays of the sun would, of course, be killed by this exposure to the direct sunlight, but many of our worst disease germs are not injured in any way by the hot sun. They could easily be carried around indefinitely.

When warm, moist, and "muggy" weather comes in our cities, we speak of it as disease-breeding weather, and this probably more aptly describes the conditions than anything else. But such disease-breeding weather would have no injurious effect upon our health if the germs of disease were not already scattered around. Sometimes a few days of warm dry weather, followed by wind, will produce the right conditions to fill the air with the germs. Right after a snowstorm or heavy rain the air is clarified, and there are fewer germs breathed in than at any other time. Every one feels the tonic of such air, and enjoys the mere breathing of it.

SOME AFTERTHOUGHTS ON THE AUTOMOBILE SHOW.

In reviewing the late automobile show in this city, we shall endeavor to indicate the general trend of design as to general external appearance, and its particular trend in mechanical details.

The New York show of a year ago, outside of the purely American types of steam and electric vehicles, had a most pronounced French aspect, especially in the gasoline car division; and while the 1903 show also, somewhat more modifiedly, presented this aspect, it was largely due to the number of imported French cars on exhibit, and the presence of some few new American cars which were of this type. Nevertheless the "Frenchiness" of style, if the term is allowable, was not as dominating as in the previous show.

As was expected by those familiar with the state of the art, three-quarters of the vehicles shown were of the internal-combustion cylinder type, i.e., gasoline cars. This increase was largely due to so many of the new makers who have entered the field adopting this type, as have some of the makers of steam carriages also.

Out of seventy different makes and distinct patterns of gasoline cars, forty showed front-motor construction, while twenty-five of the back-motor cars had bonnet fronts, leaving only a small fraction which had not wholly adopted the typical up-to-date front-motor bonnet construction of the body. The tubular frame has practically given way to the angle or channel-iron frame, or wood frames reinforced with steel plates, which the French call "*bois d'armée*."

Multiple-cylinder, vertical motors, having two, three, and four cylinders, are of course in the lead. The horizontal type is a good second, owing to the number of two-cylinder opposed style motors shown, exemplified in the Winton car; and, if the single cylinder, horizontal motors are added to these, the horizontal type may be said to lead, or nearly so. Only two makers show a three-cylinder, vertical motor (the Duryea and Toledo), the trend evidently not being in this direction. Four-cylinder vertical motors were shown by eighteen makers, a large gain in this type. Only one two-cycle motor (the Elmore) was shown. A new form of horizontal motor (the Shelby) having both ends of the cylinder open, and two pistons forced in opposite directions by explosion in a common center chamber, attracted considerable attention. This motor was constructed somewhat on the same lines as that employed by the Gobron-Brillié firm in France. The idea of this particular form of construction is, that by causing the explosion to occur between the two pistons and drive them apart, vibration is almost entirely done away with.

The surprising thing was the total absence of alcohol and kerosene motors, the reason probably being the high price of alcohol, and the difficulty of vaporizing kerosene without carbonization, which chokes the tubes and motors. No traction motors for hauling wagon trains for agricultural purposes on common country roads were shown.

Nearly all the cars had small hand levers, conveniently arranged on the steering pillar, to vary the speed by advancing the spark, or to control the motor by using the throttle valve, so as to avoid the use of the speed change gears. Foot levers to disengage the clutches, leaving the motor running free, and foot levers that freed the clutch and put on the brake at the same time were plentiful. The only thing that now demands the inventor's attention is to devise some method of starting under load, and to do away with the power-consuming transmission gears of the gasoline car, so that the motor will be as elastic as the steam engine under the throttle and the electric motor under the controller. High-speed motors were not very common, low-speed motors being mostly used.

A great many of the cars shown still had the wasteful plain bearings; but a decided tendency was shown to use roller bearings more largely than heretofore, the ball bearings seeming to bother the automobile maker, although a number of them were used, not only in the wheels and steering heads, but in the transmission gears, and on the shafts, to take up the end thrust, as on the Peerless. The only carriage in the show having ball bearings all over, including the motor, a practice that might well be adopted by other light-car makers, was a light electric Baker runabout.

The reigning European practice of mechanically-operated inlet valves was shown on about a dozen cars, the peculiar thing about it being its use on many of the small cars with single cylinders, as on the Olds, the Rambler, and the Thomas, and its comparative absence on the big cars having multiple cylinders, which still use automatic suction intake valves. Few air-cooled motors were shown. One of these was the Franklin, with a four-cylinder vertical motor of ten horse power, with flanges on the cylinder and head; while a well-known form exhibited was the waterless Knox, having pins like a porcupine's quills all over it, and a fan to aid in cooling. It was expected that electric generators would be more numerous than the batteries for sparking purposes, but a careful census showed the batteries to be in the lead. In some cars both systems were used, the battery merely being used for starting, and afterward being automatically switched out, the generator then furnishing the current. Of course the dry battery was more largely used than the storage cell, which was sometimes used to store the excess of current the generator furnished, so that in case the generator went wrong at any time, the accumulator could be called in and used for running continuously as well as starting the motor. Some of the makers, like the Electric Vehicle Company, who make a big gasoline car, the Mathewson and the Spaulding, announced that they had succeeded in abolishing the starting crank; but investigations proved these claims to be misleading and ambiguous, to say the least, the method consisting of leaving one or more cylinders, in a motor having vertical multiple cylinders, under compression, and then firing the charge with an electric spark from the battery. This, however, can only be done about once in every four trials, and then not at all, if the charge is left standing over two hours. It necessitates a very close-fitting piston and piston rings, with high compression, each of which has been had before on French cars and is not new. As proof that it is not absolutely reliable, the usual crank is provided, with a battery for furnishing the initial spark, for starting, and the generator to furnish the current when running.

Mechanical lubrication has almost wholly displaced gravity oil feeds.

Sliding and planetary gear transmissions are about equally in favor, the use of independent friction clutches coming next. Two new forms of electric and pneumatic control over the transmission gears were shown, both operated by very small valve handles at the side of the operator, thus doing away with the long change-speed levers that are in common use. The pneumatic control on the Country Club car was arranged so as to divert a minute charge of compressed gas from both cylinders into a storage tank, from which it was conveyed by piping to three small cylinders having pistons, each of which operated a clutch giving the speed desired, when the pressure was admitted through a three-way valve rotated by its controlling handle.

Single-chain drives are more popular than ever, although at the previous show it looked as if the double outside chain drive to both rear wheels from a differential countershaft would supplant this form; but the bevel-geared drives have crowded the double-chain drives out of second place. Of course, this construction carried with it the live rear axle, a large majority of the cars shown being equipped with these, which has led to a close fight for supremacy between the spur and bevel differential gear, the spur, however, being still in the lead. Direct drives on the high speed, without the use of intermediate gears, was one of the latest forms of modern practice shown.

Referring to the steam carriages exhibited, to the introduction of which the present popularity of automobiling is due, it is evident they are much more carefully constructed than formerly, and the details are better worked out. It was not to be expected that anything new would be shown in steam carriages, modern engineering having so thoroughly exhausted anything new in this line, so that all the makers in steam carriages could do was to adopt the best stationary practice to their use. Fire-tube boilers are in most common use, but flash boilers and condensers are shown on the White, which also uses a compound engine. Economy in the use of water is the desideratum, and in England condensers are a necessary adjunct, the law there not permitting the use of steam carriages on the road without condensers.

Prices at the show ranged from $500 to $8,000, and it is evident that the day of the $100 automobile, excepting the motor cycle, is a long way off. Prices on runabouts with single-cylinder motors average about $750; a heavier single-seat car, with a more powerful motor costs about $1,200; a touring car with a tonneau body costs from $850 to $8,000, the high-powered ones costing from $1,800 to $2,500, and some makes from $3,000 to $5,000; the lowest-priced steam carriage shown (the Mobile) costs $550—certainly a popular price to commend it to public favor. Many of the high-priced tonneau bodies are of the bulging shape known as the "King of Belgium" type. They are made of aluminium and can be bought separately of the carriage-body makers, to fit the *chassis*, two of the makers of these (the Berg and the Locomobile) announcing that they prefer to build and make the *chassis* only, leaving the purchaser to select the body, painting, and the upholstery elsewhere. No freaks were shown, and the entire absence of racing monsters was a sign of the tendency to build for comfort, economy, and efficiency, with moderate speed for touring purposes; and if touring over the country is not popular this coming season, it never will be. Eight makes of motor cycles were shown, but the poor man's automobile was rather overshadowed by the four-wheelers, as was the only three-wheel carriage at the show. A number of inclosed cars of the coupé type, by the Berg Company, and also the Limousine top style of the Ward Leonard, and other makers, mounted on the regular *chassis* of the gasoline cars, was shown, thus making the modern automobile an all-the-year-round vehicle instead of a summer car for the pleasant weather only. In commercial vehicles, the ponderous but yet handsome electric trucks of the Vehicle Equipment Company made the best showing, the lighter electric delivery wagons, with and without tops, sharing their popularity with the White steam and long-distance gasoline wagons of the same style.

SCIENCE NOTES.

The New York Aquarium added to its collection on December 13 a snapping turtle which was one of the best ever seen in captivity. Unfortunately, the creature died three days after it was received. It was a Mississippi snapper, and measured from the point of its beak to the tip of its tail 4 feet, 7½ inches. Its upper shell was two feet long. The total weight of the animal was 106 pounds.

A very striking instance of the deterioration of leather; produced under conditions demanding quicker tanning by the use of various chemicals, thus decreasing the durability of the material, is afforded by the fact that the British Museum expends $20,000 a year in rebinding books in leather. Modern leather is widely different from the material produced by what is now regarded as an effete process, its life being limited to fifteen years. In the search for cheaper and quicker processes of making leather, large quantities of sulphuric acid are used, and this chemical, in combination with others, causes the material to decompose rapidly in the course of a few years.

Franz, the German astronomer, published two years ago an exhaustive treatise on "The Mountains and Craters of the Moon." In this work the latitude and longitude of each mountain and crater were worked out, and since that time his book has been used in all the observatories of the world as the standard. Prof. Pickering, of Harvard, has been at work recently on a new atlas of the moon and discovered that no account has been taken heretofore of the altitude of the craters. He has discovered that the latitude and longitude measurements of each are greatly affected by the height. All previous measurements used in the study of the moon by astronomers will have to be corrected by the new series of tables, upon which Prof. Pickering is still at work.

Ever since Prof. Tyndall first discovered the movement of glaciers, attempts have been made by scientists to ascertain the exact depths of these natural phenomena by boring. Their efforts, however, have not been attended with very conspicuous success, owing to mechanical difficulties that have been encountered. But Profs. Blumcke and Hess, from Bavaria, who are well known for their studies of glaciers, have succeeded in boring through the Hintereis glacier in the Otzthal Alps, and found the ice to be 153 meters deep. The machine used for boring was driven by hand, and somewhat resembled that usually employed for experimental boring in mines, but was fitted with special arrangements for washing out fragments of ice from the bore hole to prevent their freezing together again. The expenses of the investigation, which is of incalculable benefit to science, were defrayed by the German and Austrian Alpine Clubs.

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STRUCTURAL DETAILS OF THE EDISON STORAGE BATTERY.

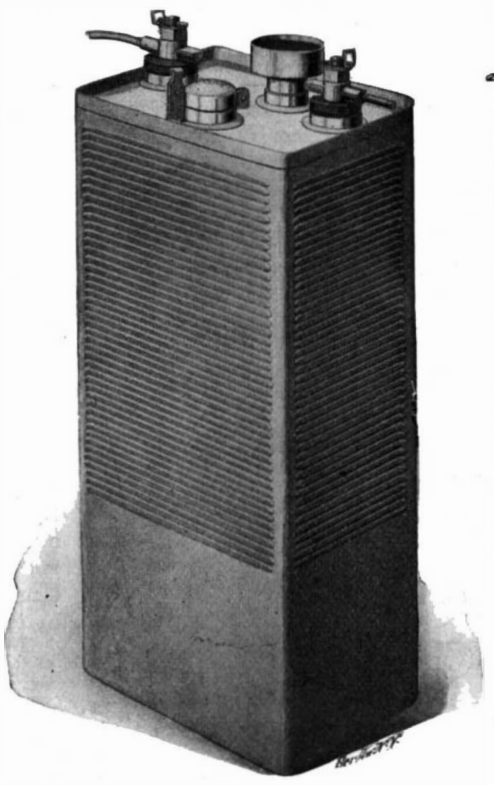
The crate of cells of the Edison nickel-iron storage battery, exhibited recently at the automobile show, gave the public a good idea of the general appearance and mechanical construction of the new cell, which is in several respects a great improvement over those of the lead type in use to-day.

In the first place, the jar used is of sheet steel, corrugated to strengthen it for about two-thirds of its height. It is not liable to crack or break, and hence is not apt to become leaky, as so often happens with a rubber jar. The plates fit tightly in the jar, with their vertical edges pressing against hard rubber side frames that have properly spaced grooves to receive them. They rest on four suitably-grooved hard rubber wedges, and are separated by hard rubber strips. All the hard rubber parts are shown in black in our diagram, and thus can be readily distinguished.

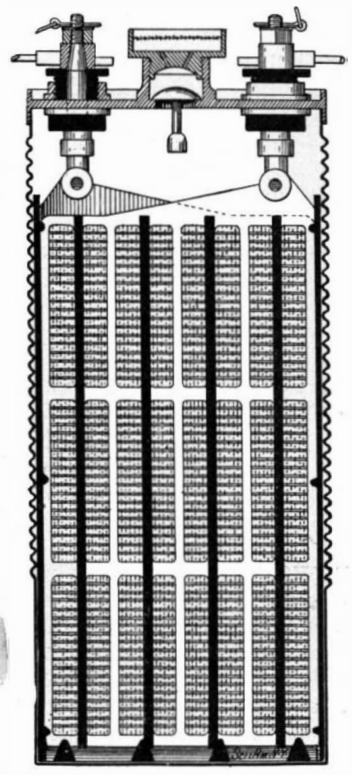
The plates themselves consist of very thin sheet steel frames, into the "windows" or slits of which are hydraulically pressed briquettes of iron-and-graphite or nickel-and-graphite (according to whether the plate is a positive or a negative), covered with perforated, steel, retaining lids. A full description of the grid and plate will be found in the SCIENTIFIC AMERICAN of June 15, 1901. The positive plates are all connected together within the cell and fastened to the positive terminal, which is brought out through a rubber bushing in the cell cover. A nut, held from unscrewing by a cotter key, clamps the connecting wire to the terminal, outside the cell. The negative terminal is brought through the other side of the cover in the same manner, and connected outside to the positive one of the adjoining cell.

There are two other openings in the cover of the cell—one for filling it and one for allowing gas to escape. The former has a hinged spring cap that opens upon releasing the catch. The gas valve has a mushroom-shaped top that, should the cell be overturned, closes the two small gas passages in the gauze-fitted cap over it and effectually prevents any liquid from escaping. The fine wire gauze, operating on the principle of the Davy miner's lamp, keeps the gas from firing back and blowing up the cell, should any of that which escapes become ignited. The cell cover fits sufficiently close upon the top of the jar to make a fluid and gas-tight joint.

The cells exhibited were of 200 watt-hours capacity, they being capable of furnishing 160 ampere-hours at an average discharge voltage of 1.3 per cell. They can be run down to 0 without damage, but ordinarily are not discharged below 0.75 volt per cell. Each cell has 24 plates 9⅜ x 4¾ inches in size and 0.1 inch thick. These plates are capable of discharging at as high a discharge rate as 200 amperes without damage. A sample plate was shown, taken from one cell of a set that had run a vehicle 3,100 miles over bad roads, and the only thing that distinguished it from a new plate was a slightly yellow coloration of the nickel-plated grid and briquette-retaining covers. The briquettes of active material appeared to be in very good condition, thus showing the cell to have a very long life and to be durable. More tests of the new battery are being made on delivery wagons in New York, after which, we understand, it will be placed upon the market this coming spring. One thing is certain, viz., that in the mechanical make-up of his cell, Mr. Edison has made so many improvements over the usual hard rubber jar as to produce a battery very much cleaner, neater, and safer than any that has yet been made. Even in the simple operation of refilling the cell by the addition of water to replace any that should evaporate from the electrolyte owing to overcharging, provision has been made that the jar should not be filled too full by devising a funnel with a telltale float that indicates when the liquid has reached the proper level.



THE NEW EDISON STORAGE BATTERY CELL.



CROSS-SECTION OF EDISON BATTERY CELL.

OIL FUEL ON THE STEAMSHIP "MARIPOSA."

BY ENOS BROWN.

The advantage of oil as fuel for sea-going vessels has been demonstrated, it is believed, conclusively, on the Pacific coast.

The steamer "Mariposa," of the Oceanic Steamship Company, was lately withdrawn from service for the purpose of renewing boilers and engines which had deteriorated through long and continuous usage. The "Mariposa" was built in 1883 by the Cramps, and is a superior type of an iron vessel. Her gross tonnage is 3,158, and she is 320 feet in length over all. When nearly ready for sea it was determined to equip her for burning oil. Originally she was provided with two double-end and one single furnace boiler carrying 90 pounds of steam. Her boiler capacity was not increased, but the new ones were calculated for a pressure of 180 pounds to the square inch. In place of her old three-cylinder compound engines, triple-expansion engines, with cylinders of 29 inches, 47 inches, and 78 inches respectively, with 57-inch stroke, were substituted. The repairs were made at the shipyards of the Risdon Iron Works.

The "Mariposa" was provided with six storage and two settling tanks, having a total capacity of 35,588 cubic feet, or 6,338 barrels, located on the port and starboard sides of the vessel. Ventilators of the trunk and cowl type extend from the fireroom and tanks considerably above the main deck. The oil is pumped from the storage tanks into the settling tanks, which are in duplicate, and containing 175 barrels each. From thence it is pumped through a heater, where it is raised to a temperature of 140 deg., and then it is forced through the burners at a pressure of 30 to 40 pounds to the square inch. The air from the receiver is raised to a temperature of 300 deg. by circulating around a special furnace front, into which it is led by pipes, finally coming in contact with the oil at the burner.

Thus equipped the "Mariposa" made her first voyage from San Francisco to Tahiti and back, covering in the round voyage 6,763 knots. The results were as follows: The average horse power developed was 2,272.75, including 120 horse power for auxiliaries. The average daily consumption of oil was 226 barrels, or 32.28 tons. The hourly consumption was 3,013 pounds The per horse power consumption, including compressor pumps, was 1,325 pounds. The amount of free air used each minute was 732 cubic feet. The total heating surface of the two double-ended boilers was 8,302 square feet, and the square feet of heating surface to each pound of oil was 2.76. The temperature of oil in storage tanks was 90 deg. to 100 deg. In heaters the temperature was maintained at 140 deg.; the temperature of the air in furnace fronts used in burners was 300 deg.; while the temperature in the uptake was 550 deg. to 600 deg.

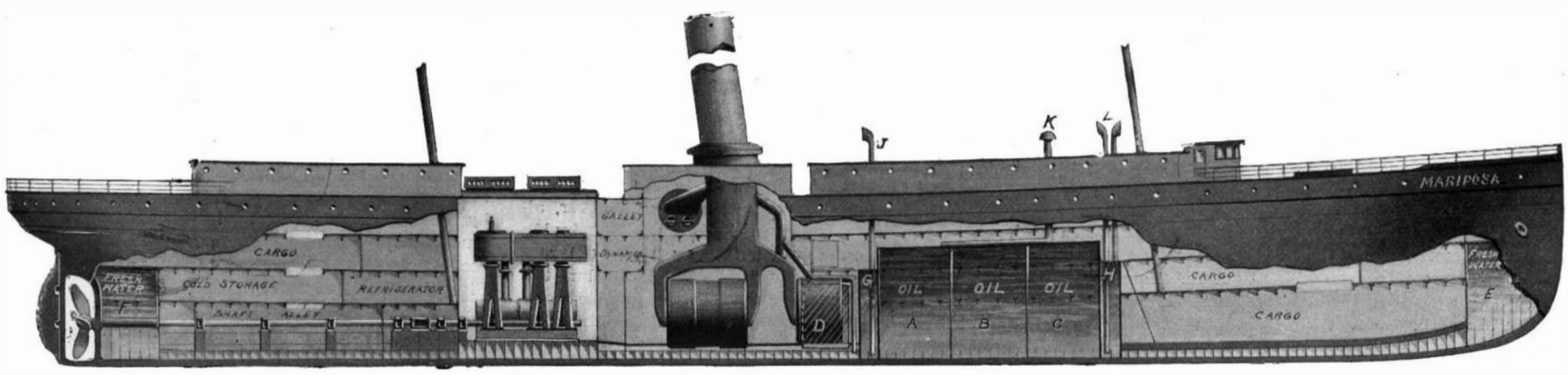
The economical results of the substitution of oil for coal, aside from saving in the cost of fuel, consisted in dispensing with the service of six firemen at $50 per month each and twelve coal passers at $40 per month—a saving of $780 each month in wages. As the engines were new and never had run with coal as fuel, the saving in this particular could not be computed. In the opinion of the chief engineer, oil at 65 cents a barrel f. o. b. equals coal at $3 a ton.

Particular attention was paid to the odor perceptible throughout the steamer on the first voyage, and the conclusion was that it was not noticeable. The absence of soot and smoke added greatly to the comfort of the passengers.

In the fireroom no ill effects of the gas were felt, the ventilation being perfect in every respect.

On the return voyage the "Mariposa" made port a whole day ahead of time. Data of the second voyage appeared even more favorable, owing to the growing familiarity of the men with the management of the new fuel. The consumption of oil on this trip was perceptibly less.

In the fireroom six men are now required, two to each watch, one only being required for tending the burners.



A PARTIAL LONGITUDINAL SECTION OF THE OIL-BURNING STEAMSHIP "MARIPOSA."

The Lore of Rheumatism Rings.

Sufferers from rheumatism who believe they will be cured of their aches through wearing a certain kind of metal ring would be surprised perhaps to hear that they are keeping alive an old superstition that owed its origin to one of the ceremonies performed on Good Friday. The ceremony was called the Blessing of the Cramp Rings, and was carried out by the King himself, who went into his private chapel, accompanied only by his Grand Almoner, crawled on his knees to the crucifix, and there blessed a silver bowl full of gold and silver rings. These rings were afterward distributed to people who were afflicted by rheumatism and epilepsy. The idea is supposed to have originated in a certain ring given by a pilgrim to Edward the Confessor, which was kept in Westminster Abbey and used as a cure for such ills.

International Conference on Wireless Telegraphy.

The Berlin correspondent of the Standard states, "on good authority," that the International Conference on Wireless Telegraphy will take place in Berlin about the end of next March or the beginning of April. England, the United States, France, Austria-Hungary, Italy, and Russia have responded to the initiative of Germany in the most friendly spirit, and the majority of these states have now intimated to the Berlin government that they will accept an invitation to such a conference on condition that the programme is fixed beforehand and sent with the invitation. The circumstance that England's official assent to the conference has not yet reached Berlin is mainly attributed to the rather difficult position in which she has been involved by the contract concluded between Lloyd's and the Marconi Company. It is, however, confidently hoped that England will send delegates to the conference, "not only because most of the naval stations are in her possession, but also," says our contemporary, "because it is believed that Signor Marconi's acquiescence in the decisions of the conference will greatly promote the future development of wireless telegraphy."

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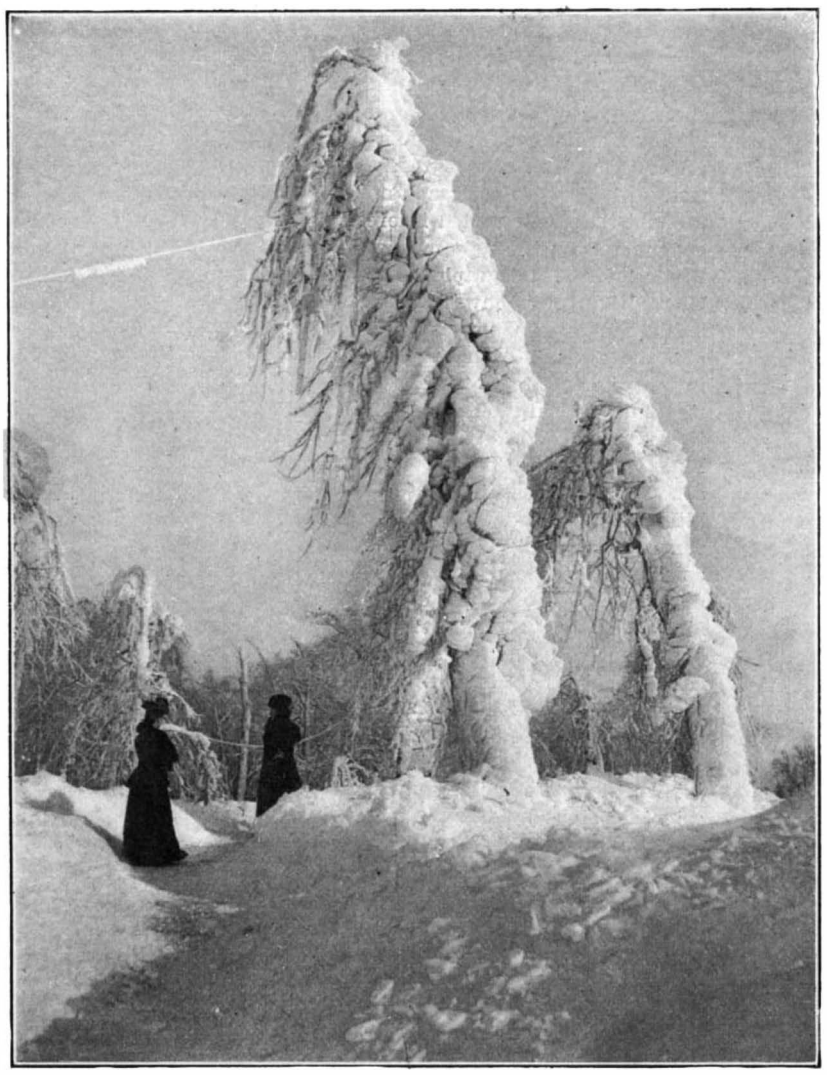
THE ICE CONDITIONS OF NIAGARA RIVER.

BY ORRIN E. DUNLAP.

The ice conditions met at Niagara Falls in the winter season are quite different from those of any other place. This is true not only so far as the scenic feature is concerned, but also in connection with the experience of the great power companies. In the majority of water power developments ice gives more or less trouble, but at Niagara the ice that has to be conquered is the result of unusual conditions that are thoroughly interesting. All of the Niagara power plants have to fight the ice of winter time, and it is a struggle of both night and day. The numerous turbines now in operation at the Falls require quite a large supply of water, and this creates a current in the upper river that sucks the ice toward and into the inlet canals. The larger part of the ice that develops the battle at Niagara is formed many miles away, in Lake Erie, and rushes down the river channels on the rapid current. When the wind is favorable for blowing the ice field of Lake Erie into Buffalo's harbor, it crowds into the entrance of the Niagara River in tremendous quantities, and the entire stream becomes a tumbling, grinding, tossing mass, pushed on by the pressure of the waters behind and pulled forward by the unceasing suction of the great waterfall.

The Canadian side also feels the effect of the flow of ice from Lake Erie, and power and water plants are occasionally interrupted in their operation by the anchor ice. Recently the pumping station of the Niagara Falls, Ont., water works was forced to idleness by the ice, and it was necessary to secure a water supply from the municipal pumping station of Niagara Falls, N. Y. This was accomplished by running a line of hose from a hydrant on the New York side across the upper steel arch bridge to a hydrant on the Canadian side. Through this hose a stream of water was sent until the Canadian plant was able to renew operations.

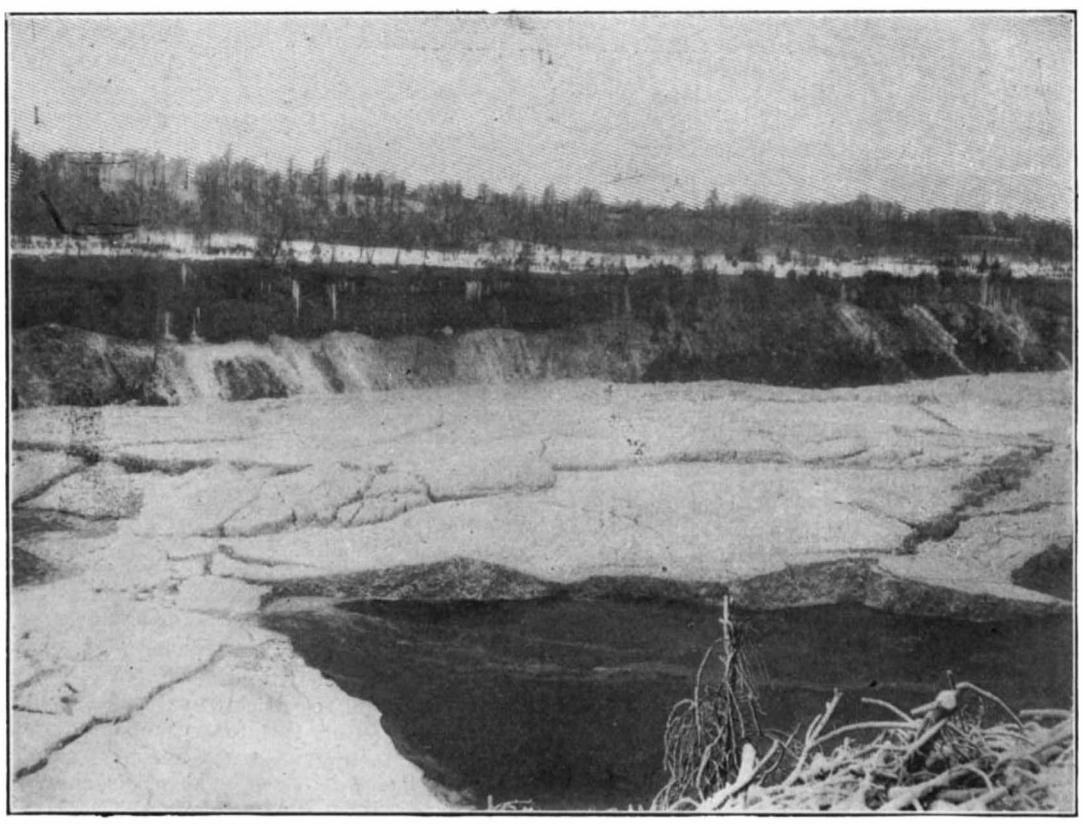
People who live close by rivers and smaller streams are quite accustomed to see them frozen over in winter, but at Niagara a peculiar effect develops when an ice bridge forms in the gorge below the Falls. It is just below the American Falls that the ice bridge usually forms at Niagara, at a point where the water is fully 190 feet deep and the current is quite rapid. The sheet of water does not freeze over like other streams and rivers, but to the contrary, the ice bridge is formed by small pieces of ice gathering in such great numbers that they jam between the two shores so tightly that a mass of great thickness and strength is formed. None of the pieces of ice is much larger than a man's hat, and they are of all shapes. This ice is not formed at the point of gorging, but on the contrary, comes down from Lake Erie. No matter what size the cakes are when they leave the lake and enter the river, in the trip down stream, through the upper rapids and in the terrible drop over the Falls, they are all churned and broken up, so that the ice that comes out from beneath the cataract is all in very small pieces. This ice fills the lower river from shore to shore. It crowds into the eddies, and is jammed tight by the force of the flowing ice pushed on by the current. The eddies become clogged until the only open channel is in midstream, and through this channel the ice pushes and grinds as it is shoved forward by the ice that continues to pour over the precipice. The quantity of the flow increases. The weather grows colder, and it is observed that the ice in the channel in midstream shows a disposition to linger. Then it breaks away again, and the grinding and forcing continue until the quantity of ice coming over the fall becomes too great to pass through the channel, and an ice jam quickly results. Then it rolls and heaves on the river. The pressure behind grows greater, and the mighty mass of quiet ice is heaved mountain high. It is firm. All motion has ceased. An ice bridge is formed—a rough, uneven, rugged mass through which deep crevices extend, affording excellent opportunity to judge of the thickness of the icy structure. At these times the water is unusually high, a condition brought about by the direction of the wind, which forces the lake waters into the river, carrying the ice field with them. When the wind lowers, the water recedes, the ice bridge settles, and becomes practically keyed over the lower river. A change of wind will once more send the water pouring in greater volume from the lake to the river, and a new and possibly greater supply of ice will rush downstream. The ice bridge already formed will act as a dam to its passage, and then, with the pressure of the cataract behind it, the new ice is hurled upon the ice bridge, and there is a wonderful change in its formation. It is made more mountainous, more beautiful, and Niagara is in its full winter glory.



ICE AND SNOW COVERED TREES.

While the Niagara ice bridge shows the power of small cakes of ice when united, the ice mountain of Niagara portrays the building ability of tiny spray drops when caught in the grasp of King Winter. It is truly wonderful to what proportions this ice mountain grows. Its massiveness amazes all who have looked upon it. So great is the quantity of ice it contains, that it is well-nigh midsummer before the last vestige of it leaves the slope close by the American Fall. While the ice mountain decays under the effect of spring sunshine, the vegetation of the bank develops beauty.

The summer foliage of many of the beautiful trees close by the Falls of Niagara would be far more attractive were it not for the fact that each winter the ice that gathers on them breaks off the slender limbs. Trees that stand near Prospect Point in Prospect Park have only trunks and a few limbs, their tops paying penalty to winter's beauty. The same may be said of the trees on Luna Island and some at Terrapin Point, where the ice gathers in great weight. It requires but a few hours to develop a wonderful change in the Niagara scene, and where to-day there is barrenness, to-morrow may be admired as the throne of winter. Occasionally beautiful frost effects may be seen in every piece of woods, but the trees of Niagara become like purest marble when the spray cloud has them within its grasp.



SCENE JUST BELOW THE HORSESHOE FALLS, SHOWING HOW THE THICK ICE IS CROWDED UP ON THE CANADIAN BANK.

Study of Transparent Metallic Films.

The method of producing thin deposits of the metals by cathode projection has been studied by L. Houllevigue, of Paris. It is observed that when a discharge is produced in rarefied gas the substance of the cathode is projected in all directions in the surrounding space. This property has already been utilized to obtain platinum mirrors and resistance strips. The experimenter has produced thin layers of various metals such as platinum, palladium, iron, nickel, copper, and bismuth; no doubt the other metals may be deposited in the same way, but carbon after seven days' discharge gave no deposit. The thin and transparent layers of metal which are deposited upon a glass surface afford an interesting study. To obtain these, a glass plate 2 inches square is placed upon a large horizontal anode plate. Half an inch above it is a horizontal plate of the metal to be deposited, forming the cathode. The whole is placed in a glass recipient and a vacuum made. The discharge is produced as usual by a Ruhmkorff coil, and the dark space surrounding the cathode comes nearly in contact with the glass. The discharge commences by driving out the occluded gases of the metal. This first period is especially long with platinum and palladium. When this is finished the substance of the cathode is driven off, and is deposited partly upon the glass opposite and partly on the metal anode plate. The deposit thus formed on the glass presents all degrees of transparency according to the duration of the discharge, which may last several hours or days. The layers present, especially in the case of copper, the iris reflections which are characteristic of thin deposits. Their reflective power is considerable. The layers do not adhere strongly, but may be easily brushed off the glass.

The study of bismuth and iron in this form when placed in the magnetic field is of especial interest. A film of bismuth obtained by this process was placed perpendicularly in a field of 2,250 units. Contrary to what might be expected, it showed no variation in electric resistance due to the action of the field. Its resistance remained unchanged at 26.9 ohms. Leduc observes that bismuth is more sensitive to the magnetic effect as its structure is more crystalline. It would seem from the above that the bismuth deposited in the thin layer is completely amorphous. A film of transparent iron placed across the magnetic field allowed the rotative effect on polarized light to be easily observed. A variation in the field of 12,250 units caused a positive rotation of 1 deg. 18 min., deducting for the glass support. On the contrary, the author has not succeeded in observing, in a film placed parallel to the magnetic field, the existence of double refraction pointed out by Righi.

One of the latest long-distance and high-speed electric railways is between Seattle and Tacoma.

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AN IMPRESSION OF MARCONI.

Only five years have passed since the general public first heard of Marconi. Scientists, to be sure, had known of him as a young man who was carrying on the work of Hertz and his immediate successors. When, however, Marconi made his first successful experiments in transmitting messages for short distances without wires, the newspaper men scented a good "story," and proceeded to write him up for a sensation-loving world in their best and most flaring style. He is now one of the most "interviewed" of public men. Reporters hunt him; and when they drive him to cover, they haunt him. Hardly a day passes but he is talked at, questioned as to his work, and begged to give some exclusive bit of information. He has been photographed in all possible positions. He has been interviewed at all possible times, and sometimes at impossible times. Clearly Marconi has learnt that fame is its own punishment; and that he must submit to the delicate torments of the inquisition instituted by the modern press. No wonder that he leaves the impression of being intensely wearied by interviewers. At best he is but pleasantly unhappy with them.

When you meet him for the first time, you know that he is not a cordial man; and yet you feel that he will not rebuff you, that he will probably do for you what he can. His manner is that of chilly reserve. In the press he is referred to as "the young Anglo-Italian" who has done some startling things which are not very clearly explained. "Anglo-Italian" may be a designation accurate enough politically; it is hardly characteristic of the man as he appears in the flesh. Italian blood flows in his veins, it is true; but he is English for all that—English in his bearing, English in his dress, English in his speech, save for the least perceptible foreign intonation. Not the faintest spark of southern fire ever flares up within him. A cool, calculating man of the North, is this so-called Anglo-Italian.

For a successful inventor Marconi appears the least joyous of men. His features are melancholy in expression. They are those of a man fast approaching forty—not those of a man of twenty-eight. His face is impassive, his eye almost cold. When he smiles he half shuts his eyes, wrinkles the muscles of his cheek, and draws up the corners of his mouth. It is not a pleasant smile.

If you visit Marconi with the expectation that he will do the most of the talking, you will find that you are grievously mistaken. You must do the talking yourself. To be sure, he answers questions frankly and fully; but he will not converse voluntarily. You discover quickly enough that his reticence is the reticence of modesty. When he discusses the Marconi system of wireless telegraphy, he refers to it as "our" system, not as "my" system. He praises where praise is due, recognizing fully that it is not given to any one man to learn all the secrets of science, and that great results are attained usually by the co-operation of many minds working to a common end. He acknowledges fully and openly how important to himself has been the work of his predecessors, and even that of some of his contemporaries. "The success of the experiments with which I have been engaged is the logical result of the work of myself and of my assistants in the last few years, and of scientific investigations of the latter part of the century," he himself says. "Revolutionize" is a word not included in the vocabulary which he uses to describe the possibilities of his invention. He frankly admits that it is not his purpose to render submarine cables useless; he is satisfied if he can successfully compete with them; or if he can only make them cut down their present rates.

And yet, he talks of his system with a certain air of easy confidence, which leads you to infer that if any man will ever succeed in outdoing the submarine cables, it is Guglielmo Marconi. It is not often that he prophesies; and when he does, you feel that he knows; or as he himself puts it, "It is not my policy to make a statement before I am absolutely sure of the facts." When he told the representative of the Scientific American that in a few months a regular transatlantic wireless telegraph service would be established, he said it in a way that left no doubt of the thing.

Although he is modest, he does not wrong himself by belittling his own work. He talks of his magnetic receiver almost objectively, as if it were the production of some other inventor's mind, which is all the more noteworthy because the instrument in question is, probably, the most valuable contribution to wireless telegraphic apparatus made since the invention of the coherer. He admits his receiver's great speed and its general merit, and expresses his opinion of its recent remarkable performance at Cape Cod in terms of mild approval, which are, however, not utterly devoid of a tinge of pleasure. It is difficult to picture Marconi's waxing enthusiastic even over a very great achievement. It is significant that the newspaper men who saw him after his wonderful feat at Cape Cod merely reported him to be in exceptionally good humor.

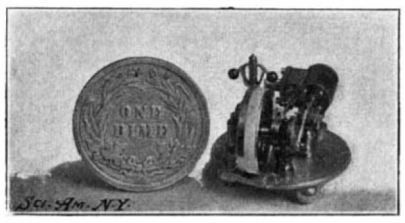
He has had unusual obstacles to contend with in the development of his ideas. There have been technical difficulties, of which he is now fortunately able to speak as things of the past. The reason for these difficulties he describes in a simple way without a trace of the pride that he probably feels in having overcome them. "Any other machine," he says, "enables the inventor to shut himself up in a room and announce results when it is wise for him to do so. Wireless telegraphy is different, especially in the way that we labor. It is not a case of one machine here and one in England; but of half a machine here, and another half in England. And each of these machines must be adjusted, the one to the other."

More formidable even than the inherent technical difficulties of space telegraphy itself was the opposition of the British telegraph and cable companies, who thought that their vested interests of $400,000,000 were endangered by the new means of communication. Officials of the telegraph and cable companies have blocked Marconi's onward course wherever they could. Subject to government control as the telegraph systems are, the authorities have been discourteously slow to grant privileges to Marconi. They allowed him to send messages to ships three miles from land, but when the vessels came within the two and one-half mile limit, communication was forbidden. When he is asked to tell something of these trials, he answers, not bitterly as one might expect in a man who has been sometimes balked, but smilingly, in amused toleration, as if the experience was to have been foreseen. He does not gloat over the failure of the companies; he simply says: "I think this opposition has at least been ineffective." If you question him as to the commercial success of his invention, he points for an answer to the sixty English warships, twenty-five Italian warships, and a score of Atlantic liners equipped with his apparatus.

Nice distinctions in giving credit for the purely scientific steps by which results in transoceanic communication without wires have been attained, are here out of place. It is pleasing to note, however, that the resolution of Senator Hoar, of Massachusetts, tendering the thanks of Congress to Marconi for the good he has done mankind, shows that our own government is keenly alive to the permanent benefit which has accrued to it as well as to the world from Marconi's work. As he himself recognizes the merit of the labors of those who went before him, it is fitting that others should recognize the fact that his organizing talent has brought together a hundred contributory speculations and detached discoveries into harmonious relation, and has given us a system of wireless telegraphy, still susceptible of improvement in many respects, no doubt, but practical in the attainment of results scarcely deemed possible by present agencies.

AN OPERATIVE ENGINE THE SIZE OF A DIME.

A number of tiny engines have been constructed at different times, but doubtless the smallest which has yet



AN OPERATIVE ENGINE THE SIZE OF A DIME.

been built which is actually operated was recently completed by Mr. A. G. Root, of Danbury, Conn. As the photograph shows, it stands on a piece of metal just the size of an American ten-cent piece, the materials of which it is made being gold, silver, brass, and steel. The largest part of the engine is less than a half-inch in length, the flywheel being but 7-64 of an inch in diameter, while the main shaft of steel is but 5-16 of an inch in length. The band of the flywheel is of gold. The total weight of the engine without the base is but three pennyweights, and its total height is less than a half-inch. In making the various parts and putting them together it was necessary to use a magnifying glass on account of the delicacy of the work, yet the engine runs perfectly, compressed air being used for power applied through a tiny tube. As long as the air supply is maintained, it continues in motion. The horse power developed is so small that it cannot be estimated.

Improvement in the Braun System of Wireless Telegraphy.

Prof. Ferdinand Braun, of Strasburg University, announced before the Strasburg Scientific Society that he has discovered a method of producing electrical energy of unlimited volume and projecting it into space in the form of electric waves to any desired distance. Prof. Braun claims that his new method secures greater accuracy of transmission in wireless telegraphy and that he attains a more perfect attunement of transmitting and receiving instruments.

Engineering Notes.

It is safe to say that none of the industries have been so substantially benefited by the present era of prosperity as that of locomotive and railroad rolling stock construction. It was announced a few weeks ago that the Canadian Pacific Company was compelled to send an order for locomotives to Scotland, for the reason that it could not be placed in this country except for delivery in the remote future. This order involved twelve ten-wheeled modern locomotives.

Mr. Matthews, the engineer-in-chief of the Trinity House, England, has been carrying out a series of experiments with the Kitson incandescent oil vapor burner, for the purpose of introducing it into the lighthouses around the English coasts in the place of the oil and wick burners now generally employed. He has introduced several modifications in the arrangement of the burner to adapt it to the special requirements of lighthouse illumination. The principal improvement is a considerable increase in the intensity of the incandescent mantle by more effectually mixing the air with the oil vapor; reducing the interference of the associated tubes to the minimum; and also rendering the pressure of the oil vapor more constant and uniform. In the course of his experiments, the engineer has also found it possible to use an oil having a flashing point of 160 deg. F., thus adding very considerably to the safety of using this form of burner for lighthouses. A practical trial of this improved burner has been made at the lighthouse at Lowestoft on the east coast for some months past, and it has proved to be simple and safe in manipulation, the light produced being of very high power, steady, and dispensing with trimming or frequent adjustment of the draught. The consumption of oil for the incandescent burner is estimated to be about one-fifth of the quantity expended with an ordinary lighthouse burner consuming oil with concentric wicks, while the increased luminous intensity produced by the former as compared with the latter is claimed to be no less than ten times greater. Under the circumstances this incandescent oil burner is likely to prove a great success for lighthouse work. Its application is just at present limited to optical apparatus of small size, the large lens arrangement now set up in many lighthouses being adapted for oil flames of much larger diameter than that of the incandescent mantle. A system of somewhat similar kind has been in experimental use in some lighthouses in France, and the officials of the French lighthouse service are so impressed with the possibilities of the system and its simplicity of working that they propose to extend its application. The Trinity House authorities are also contemplating the introduction of this type of burner in the light house recently constructed on the foreshore below Beachy Head.

The Death of James Wimshurst.

On January 3 James Wimshurst, F.R.S., passed away at the age of seventy years. He was the second son of Henry Wimshurst, who introduced the screw propeller. After receiving an education at Stebonheath House, London, he entered into business with his father. Later he joined the professional staff of Lloyd's Register, remaining there for some eight years. After occupying the chief position with the Liverpool Register of Shipping for a considerable period, he received an appointment to a principal position in the Consultative Branch of the Board of Trade.

In his spare time, Wimshurst devoted himself to scientific pursuit. Twenty years ago he published the particulars of a large and very powerful influence machine which he had designed and made. These machines are now well known throughout the world by his name. In 1893 he designed and exhibited a system for connecting lightships electrically with the shore stations. Wimshurst's work was notable for his steady and persistent refusal to accept anything in the way of money for his labors.

The Current Supplement.

The current Supplement, No. 1414, is largely devoted to naval matters. Lieut. Spear discusses at length the strategical value of submarine boats in modern warfare. For the purpose of illustrating Lieut. Spear's discussion many engravings of the various types of submarine boats have been provided. Fred. T. Jane continues his interesting naval war game articles. The electrical department of the number contains articles on "Atmospheric Electricity and Earth Currents," by E. O. Walker; "Fishing by Electric Light," and "Electricity Works in Switzerland and Water Power." The Dutuit collection of valuable archæological curios is fully described and illustrated. Some account of the origin of terrestrial plants will be of interest. The Trade Suggestions from United States Consuls and Trade Notes and Recipes are also published. E. O. Hovey concludes his *resumé* of the proceedings of the annual meeting of the Geological Society of America.

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Correspondence.

American Commercial Expansion.

To the Editor of the SCIENTIFIC AMERICAN:

In your very interesting article, "The Mechanical Inventors of Lancashire, England," by Sir W. H. Bailey (SCIENTIFIC AMERICAN SUPPLEMENT, No. 1410, January 10, 1903), you say, referring to the invention of the puddling furnace by Henry Cort, of Lancashire: "Previous to that year, 1783 (date of Cort's patent), no English iron was used for the purposes of the English navy. As much as £35 a ton was paid for Russian or Swedish iron, for English iron was bad in quality, and, as a means of removing the impurities from it, the furnace met with immediate and remarkable success."

Previous to the birth of Henry Cort (1740) the manufacture of bar iron in the North American colonies had already favorably engaged the attention of the authorities of the English navy. Its superiority was pronounced, and of such an excellence, even as early as 1735, as to extort the highest encomium from officials of the British Naval Board.

The Americans engaged in the manufacture of iron at a very early period. In 1621 Virginia led the way, and was followed by Massachusetts in 1628.

They made, however, but little progress, as the mother country adopted the policy of restricting their manufacturing spirit by administrative means.

In 1660 the British Parliament passed an act prohibiting the American colonies from exporting any of their manufactures to England in any but English-built ships, although in direct violation of the charter of Virginia, which empowered the people of that colony to carry on a direct trade with foreign countries.

In 1669 England imposed a duty of 10 shillings per ton on all iron imported from the American colonies. It was afterward proposed in the House of Lords to prohibit the American colonies from manufacturing ironware of any kind "out of sows, pigs, or bars," under a heavy penalty, which did not, however, become a law, but displays the fact of aggressive American enterprise even at that early date.

No colony of any other nation during any period of the world's history can be cited whose industrial energy extorted such a tribute as this proposition to prohibit American manufactures for fear of an American invasion, two hundred and twenty-four years ago. It is an astonishing industrial become of American progress, unique and unparalleled.

In 1731 an act was passed by the English Parliament directing the Board of Trade to inquire into and report on the laws made, manufactures set up, and trade carried on by the American colonies. In the following year, 1732, they accordingly reported that *iron works had for years* been established in Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Maryland, and Virginia; and from the progress they had made, it was deemed expedient to encourage the manufacture of iron in the colonies, especially as the production of it had greatly fallen off in the mother country.

Owing, however, to the opposition of the English manufacturers, Parliament in the same year, 1732, passed laws prohibiting smelting furnaces, rolling or slitting mills, tilt hammers, etc.

England herself, by restraining and even prohibiting the domestic industry of the Americans so long as they remained in the condition of colonial dependencies, had trained them to consider the establishment of home manufactures as an act of patriotic resistance. The confidence of the colonists previous to the revolution was expressed by Hartley of Pennsylvania: "We are able to furnish some domestic manufactures in sufficient quantity to answer the consumption of the whole country, and to work up our stock of material even for export."

Prohibitive legislation indicates too clearly that long before 1783 America was practically in advance of England, possessing better raw material and superior mechanical ingenuity and enterprise. So much for the manufacture of iron previous to 1783. Let us *glance at the facts as to the reputation of American manufactured bar iron among competent officials of the English navy, previous to* 1783.

Copy of a letter from officers of his Majesty's navy yard at Woolwich to the Navy Board, dated September 3, 1735, reads as follows:

"We have lately received from his Majesty's yard at Deptford, bar iron 2¼ inches broad and 1½ inches thick, 15 cwts. 0 qrs. 4 lbs.; squares of ⅞ of an inch, 5 cwts. 0 qrs. 12 lbs.; imported by Mr. Crawley from America; and pursuant to your warrant of July 11, 1735, have made sufficient trial of each of the sorts, find the same iron to be very good, and fit for his Majesty's service, superior in every respect to the best Swedes iron, and in our opinion worth £17 10s. 6d. per ton."

They also wrote to the Navy Board on July 17, 1736: "That from the trials we have made from one ton of iron (bar) imported by Mr. Crawley from America, it is, both in the nature, and goodness, and value, equal in all respects with Swedes iron."

Mr. J. M. Swank, in his exhaustive work, "Iron in All Ages," says: "For a long time in America, the needs of the iron trade were for the small rods and bars necessary in the production of nails, wire, and articles of household hardware or for castings."

In 1731 the first rolling or slitting mill operated in America was erected in Massachusetts Bay. With a two-high train the iron bloom was lengthened into a bar and then in the "slitting" machine this bar was cut into longitudinal sections by means of rotary cutters, consisting of steel disks. This was the mode of manufacturing rods which entered into so many of the merchantable products of the period. In 1750 an act of Parliament which forbade the erection of rolling and slitting mills in the colonies was put in force, and, though bar and pig iron continued to be manufactured, there was but little progress made in the industry until after the revolution.

The bar iron referred to in the aforesaid report to the English Navy Board was made by the two-high train rolls; although most of the American iron of that period was drawn under the tilt hammer.

Thus American commercial invasion, it would seem, is not a creation of recent growth. It was in evidence, as regards use of American iron in the English navy, over one hundred and seventy years ago.

The selfish obstinacy of the British manufacturers in their appeals to Parliament brought about the prohibitive laws of 1732 and 1750 against every industrial effort, but more particularly were these laws aimed at the magnificent iron industry which is pre-eminent in America to-day.

America has, however, by a survival of the fittest, grown to her proud position, which was assured more than a century ago by the marvelous resources which the present generation has developed in the characteristic American fashion. S. CHAMBERLAIN.

Buffalo, N. Y.

The Needed Increase of Our Navy.

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the "new ships for the navy," and the necessity for "an elaborate programme of construction," in your issue of the 17th instant, Senator Joy's bill providing for the construction of twenty-five battleships, Senator Hale's opposition to the construction of modern high-powered battleships, and the recent organization of a Navy League in the United States, are all subjects of considerable importance to the nation, as well as of considerable interest to naval folks and citizens in general.

The necessity for a programme of construction, although more keenly felt now than ever before, brings to mind the fate of one that was drafted in 1881 by a special board appointed by Secretary of the Navy William H. Hunt. This board, with Rear-Admiral John Rodgers presiding, "advised the construction of twenty-one armored battleships, seventy unarmored cruisers of various kinds, five rams, five torpedo gunboats, and twenty torpedo boats, all to be built of steel." This programme was thought to be necessary as a nucleus for a modern navy at a time when neither the Philippines, Hawaiian Islands, Porto Rico, nor any other outlying possessions existed to divert our attention during war times. If such a programme were deemed necessary twenty years ago, what must be the increased necessity to-day, with our advent into international politics, and consequent dealings with powers whose naval forces have become our superiors?

It has taken nearly twenty years to build up the United States navy to the strength advised by the Rodgers board; in other words, we are twenty years behindhand; but what else is to be expected with the present method of obtaining favorable naval legislation? At one time construction was delayed one year by the chicane policy of Congress in appropriating three of the heaviest fighting vessels, yet at the same time placing a clause in the appropriation to the effect that no contract for construction should be made until that for the armor had been previously made, the price for the latter being also fixed at a figure considerably lower than it was possible to obtain it. Other delays have been due to the failure of Congress to make any appropriation, on the ground that our shipyards were taxed to their utmost with government and private work already on hand; yet while we have been waiting for our shipyards to clear their ways, no less than six vessels of war, from protected cruisers to battleships, have been or are being built for Japan, Russia, and Turkey. Thus we fail to see the validity of such excuses.

With this and other opposition in mind, the introduction of a bill by Senator Joy, of Missouri, providing for the construction of twenty-five battleships seems a bold step, and its outcome is of extreme importance for several reasons. If the construction therein provided for is to be completed within five years, our navy would at the end of that time be up to the strength of what it ought to be to-day. We would be in possession of about forty-five battleships; but in the meantime Germany, who only a few years ago had a very low position in the rank of naval powers and is now rapidly overtaking us, will also possess at least an equal number of battleships, as provided in a naval programme adopted by her some years ago; so that, bold as Senator Joy's bill may appear at first, but slight thought will convince one that after all its provisions are, if anything, modest and that thirty battleships would be none too many. The inadequacy of former appropriations since the beginning of the new navy is also forcibly shown. And furthermore, whether Senator Joy's bill provides for one or fifty battleships, no material benefit would result until at least three, and possibly five, years after its passage—the time required for construction; and in the meantime nations could be created or exterminated, so that the passage of such a bill, provided it also includes an immediate increase in the personnel of not less than 14,000 men—whose thorough training would require as much time as the construction of their ships—and also for supernumerary ships with which to replace those drawn out of active service as being obsolete or deteriorated, could not be too readily effected if we are to enforce the Monroe Doctrine and impress aggressive foreigners with the importance of respecting it.

It is to meet problems such as this, and to give to the nation in general a naval education, that the recently organized Navy League of the United States will have a wide field for operations.

CARLOS DE ZAFRA.

312 West 81st Street, New York,
January 22, 1903.

A Plea for the "Tripper" System in Railroad Signaling.

To the Editor of the SCIENTIFIC AMERICAN:

The terrible disaster which has just occurred at Graceland, N. J., presents another strong argument in favor of the so-called "tripper" system in connection with railroad signals. In the investigation of the New York tunnel accident assertions were made that the best and most approved forms of signals were in use. Nevertheless, if the tunnel had been provided with "trippers" the accident would probably never have occurred. At Graceland again, the use of a properly-arranged "tripper" system would undoubtedly have avoided disaster.

Modern automatic and interlocking railway signals have been brought to such a state of perfection as to make it practically impossible for a wrong signal to be given. Much effort and money have been expended in the attempt to free the operation of signals from the element of human fallibility; but of what avail is this effort if the signals are to be disregarded by a human engineer? An automatic device which would open the train pipe of the air brake if an attempt were made to run the train past a danger signal would remove this most menacing feature. It is a well-established principle that safety devices must, as far as possible, be automatic and independent of human intervention. Why this principle has not been more generally applied to the stopping of railway trains is a difficult question to answer. The patent files are filled with devices intended to accomplish this. Many of them are entirely practicable. In a few isolated instances they are used, and used successfully, but they have never met with the general adoption which they deserve. The writer has often tried to ascertain why the use of these devices is not more general, but without very satisfactory results. The most logical reply has been that it would discourage watchfulness on the part of the engineers by leading them to depend too much upon automatic appliances. The plan of sealing the stopping mechanism and imposing a severe penalty for breaking the seal would, it seems, dispose of this objection. No one would think of such a thing as allowing a modern elevator to be dependent entirely on the skill and watchfulness of the operator to prevent it from going through the top of the house. The most carefully planned automatic devices are provided to prevent such occurrences; yet a railroad train, traveling at terrific speed, and representing enormous energy, is allowed to run without any safeguard between itself and disaster beyond the watchfulness of one man, who may be taken ill, or suffer from a temporary mental aberration, or may even die suddenly and unnoticed.

One of the most dangerous elements in railway operation is the tendency of most men to take chances. It is to be hoped that railroad management does not encourage this tendency by bringing too much pressure upon engineers to make time. However this may be, the introduction of the "tripper" system would make it a physical impossibility for a train to pass a signal set at danger. Trains might make slower time if a superfluous regard for signals were thus enforced at all times, but it seems as if ample compensation would be realized in the greater safety to the traveling public. WILLARD P. GERRISH.

Harvard College Observatory, Cambridge, Mass., January 28, 1903.

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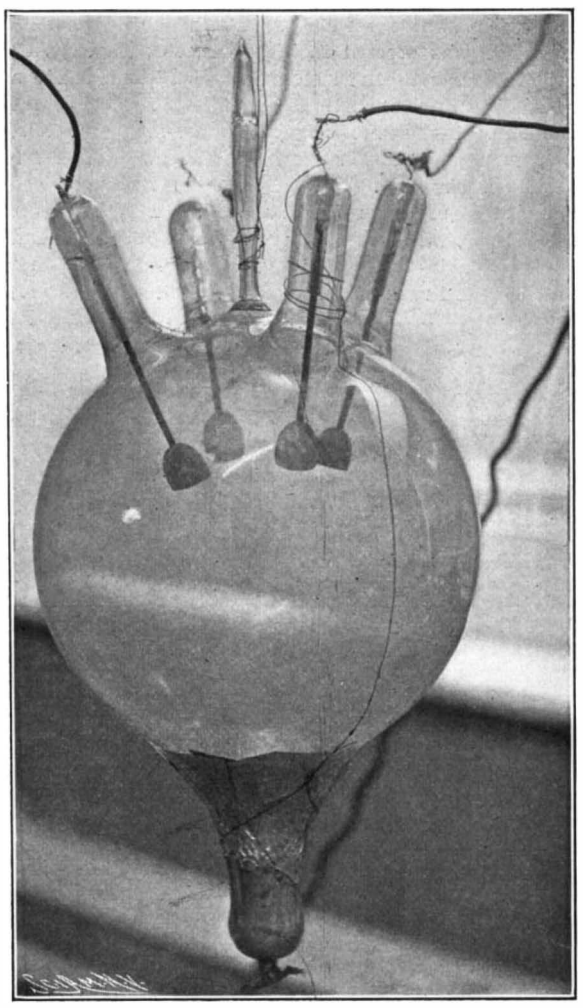
THE COOPER HEWITT LAMP AND STATIC CONVERTER.

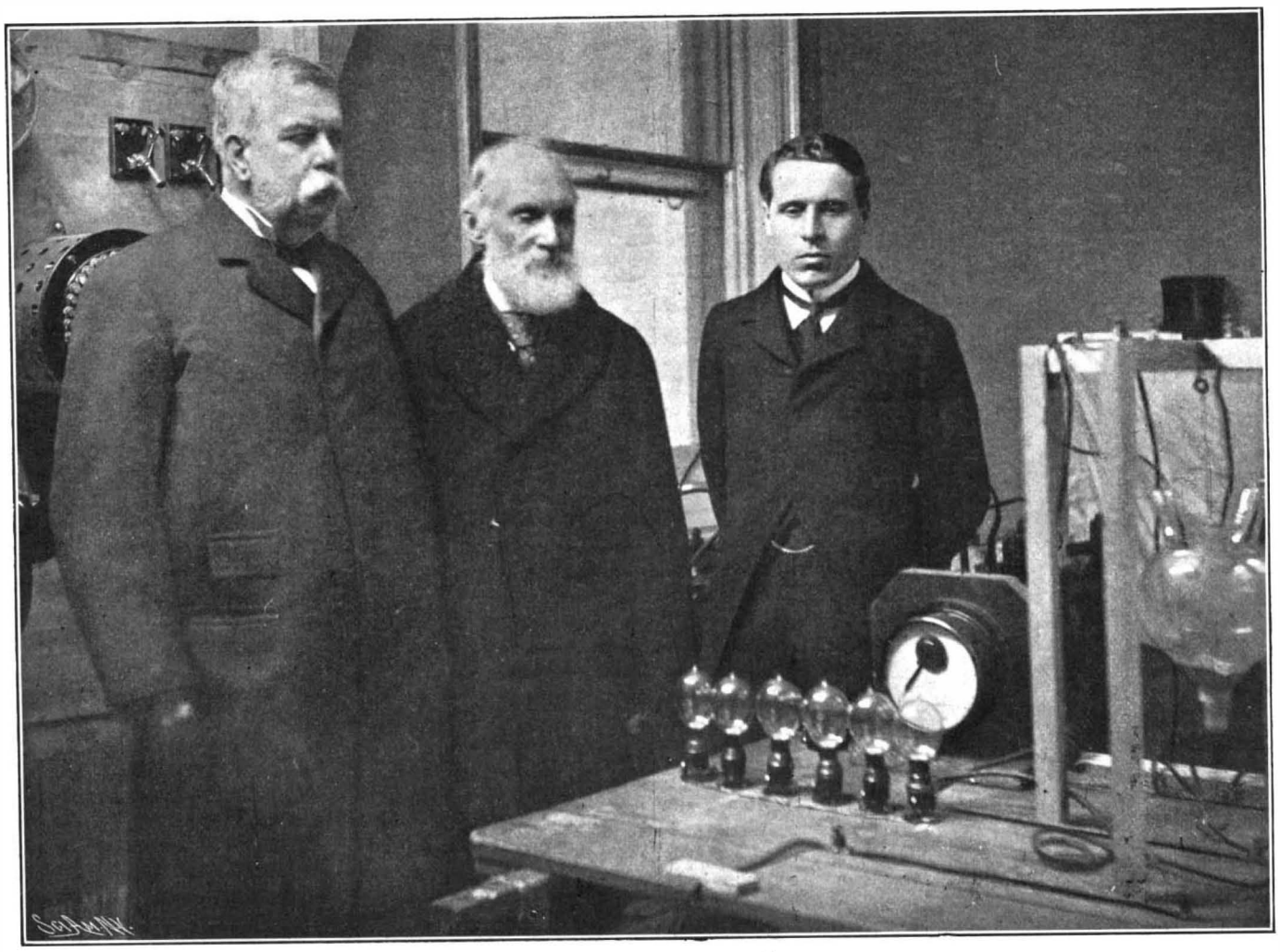
Great interest attaches to the exhibit by Mr. George Westinghouse, during his recent stay in London, of the new lamp and converter invented by Mr. Peter Cooper Hewitt. The lamp was shown in its commercial form to Lord Kelvin and a number of other prominent men, and the curious "static converter" was there, for the first time, brought before the public. About two years ago the Cooper Hewitt lamp was shown as a laboratory apparatus at a "Conversazione" at Columbia University, and was described at that time in the SCIENTIFIC AMERICAN.

The lamp in its present form consists of a glass tube of any desired shape with a bulb at one end which contains a small quantity of mercury. All air is exhausted from the tube, which thereupon fills with vapor from the mercury in the bulb. Electrodes are provided at each end of the lamp, the negative electrode in the bulb of mercury and the positive electrode at the opposite end. On passing a direct current through the lamp, the vapor which fills the tube is rendered incandescent and gives off a steady, blue-white light. Owing to the great resistance at the negative electrode to the initial flow of current, it is necessary to use a high voltage to start the lamp. This is commonly done by passing a spark from a "choking" coil through the negative electrode, which when once penetrated offers but slight resistance to the flow of current. If for any reason the current is interrupted, the high resistance is immediately resumed and must be broken down again before permitting further flow of current.

The light given off by the incandescent vapor is entirely lacking in red rays, and this has its advantages to the eyes, for, as is generally known, red rays are the most injurious to the eyesight. However, owing to this peculiarity of the light, some very extraordinary color deceptions are produced. Different shades of red reflect only the colors with which they are mixed, assuming colors varying from a dirty brown to a bright violet. In Mr. Hewitt's laboratory, where three of these lamps are used, a soft, well-diffused light is produced. Laboratory attendants affirm that they prefer to work under this light than with ordinary daylight, and have become so accustomed to the absence of red rays that they can, to a large extent, discern the true color of any object brought into the room. To the uninitiated, however, the appearance of the room is startling, indeed. One is at once struck with the green appearance of all woodwork, and then with the green and purple blotched faces of the draftsmen. A question which Mr. Hewitt usually has to answer when exhibiting these peculiar color deceptions is, "Why don't you put a red globe around your lamp and thus get red rays?" This is apparently an easy solution of the difficulty until one is reminded that red glass does not change light waves, but simply suppresses all the rays that are not red. Since there are no red rays in the Cooper Hewitt lamp, the effect of the red globe would be to cut off all the light. It has been Mr. Hewitt's aim, therefore, to discover some material which would act as a transformer to change some of the waves of light into red waves. In this search he has met with considerable success, finding that silk dyed in rhodamin gives very satisfactory results, the only objection being that the power of the light is somewhat reduced on using this transformer. A simpler method of rectifying the deficiencies of this lamp is to blend its light with an equal power of the ordinary electric light. This combination also results in great economy of current because the Cooper Hewitt lamp is probably the cheapest artificial light in the world. The mercury vapor lamp consumes one-half watt per candle power as against 3½ watts in the incandescent lamp. Thus if the two lights are combined in equal quantities, the resulting light would require only two watts per candle, a saving of 1½ watts per candle over the ordinary incandescent lamp. On account of its wonderfully low cost, the Cooper Hewitt light should be found very useful, without the addition of any rectifying light, for illuminating factories, yards, etc., where the differentiating of colors is unimportant. Another promising field for the new light is that of photography. Being rich in actinic rays which most affect the photographic plate, the mercury vapor lamp is found to give excellent results. It has been in commercial use for purposes of photography for some months, and its practical value has been thoroughly tested. One of our illustrations is a reproduction of a photograph of Mr. Hewitt and Lord Kelvin taken under this mercury vapor light.



THE COOPER HEWITT STATIC CONVERTER.



Mr. George Westinghouse. Lord Kelvin. Mr. Charles Merz.

WATCHING A TEST OF THE COOPER HEWITT CONVERTER.

In the course of his experiments on the mercury vapor lamp, Mr. Hewitt discovered his "static converter," to which we have referred in a previous issue. This converter, or arrester, as it might more properly be called, acts to check the negative waves of an alternating current, permitting the passage of the waves in the positive direction only. The apparatus is similar in every respect to the lamp except that several positive electrodes are provided, one for each winding of the motor and another for the starting device. The lamp is also made spherical, so as to provide a larger area for dissipating the heat in the apparatus, and at the same time to reduce the distance between the positive and negative electrodes, with consequent reduction in the waste of current. Our diagrams illustrate the connections with a Y-wound three-phase circuit. As in the case of the lamp, the resistance of the negative electrode must first be broken down before a current will flow. This may be done by connecting the converter with a circuit containing a "choking" or "kicking" coil, and causing a spark to jump between the electrode *a* and the negative electrode *e*. This breaks down the resistance of the latter electrode, and permits current to flow therein from electrodes *b*, *c*, and *d*. No current can flow back into any one of the positive electrodes when it becomes negative to the others, because its resistance has not been broken down. Thus it is that a path is provided for the current in positive direction only, while the circuit for the negative flow is open. The extent to which the negative electrode resists the flow of current, and the amount by which it is reduced while a current is passing, will be readily comprehended when we remember that the difference of potential between any two of the upper electrodes is at times far greater than between them and the electrode *e*. A two-phase or single-phase current could not flow through the converter, because in these currents there are periods when no positive current is flowing, which would permit the high resistance at the electrode *e* to be resumed, stopping the flow entirely. With a current of three or more phases no such negative periods exist, and a constant flow is assured. The negative portion of the wave may be ignored or, if desired, it may be used on another circuit. In either case no power is lost. The current as it flows from electrode *e* is of a pulsating character, though flowing in one direction only. The circuit is completed to the neutral point of the Y-winding. We have illustrated this circuit as containing a storage battery, a number of incandescent lamps, a direct-current motor, and several arc lamps.

During the operation of the converter the mercury of the negative electrode is in constant motion, due to the pulsating character of the current. The mercury vapor as it rises in the globe is condensed on the glass, and trickles down the side of the vessel back to the mercury reservoir. In this way the mercury which is vaporized is constantly being replaced by the condensed metal. It is on account of this action that mercury is used instead of some other substance. Mercury is an elementary substance, and having scarcely any effect on iron, which is used for the positive electrodes, forms no objectionable chemical compounds, such as might occur with some other substances. An interesting feature of Mr. Hewitt's converter is the fact that the loss due to a passage of current through the lamp is constant at 14 volts. Thus with a current at 140 volts there will be a 10 per cent loss, while at 1.000 volts the loss would be only 1.4 per cent. From this it follows that the greater the voltage the smaller the globe necessary to dissipate the heat produced.

The advantages of this apparatus are of the most revolution-

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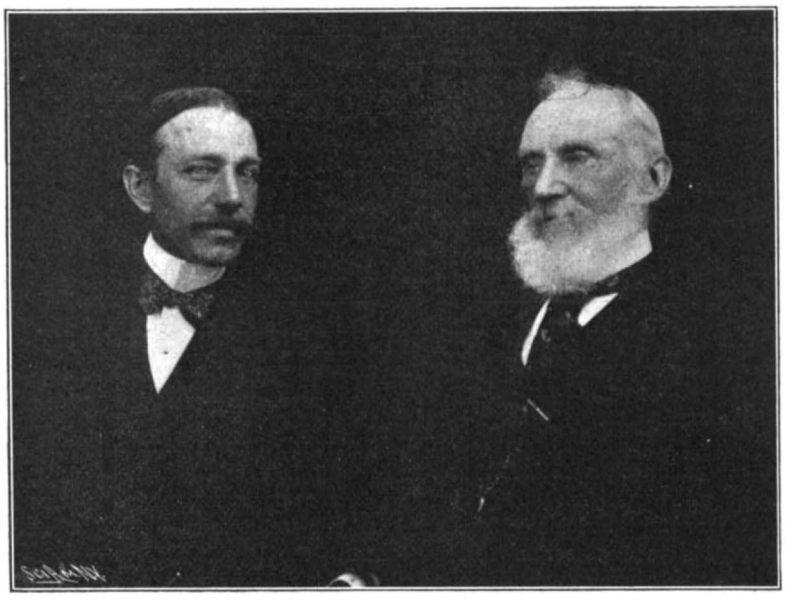
ary character. The expensive and bulky rotary converters of to-day would be displaced by these simple globes, and the operating expenses of our substations would be cut down to a very trifling sum. Many other uses will at once suggest themselves to our readers, all of which would be too numerous to mention here.

Mr. Hewitt has obtained fifteen patents covering the principles involved in his system of lighting, and has entered into an agreement with Mr. George Westinghouse for the sale of all his patents to the Cooper Hewitt Electric Company. The company has control of both the lamp and converter. A factory is being installed in New York for the manufacture of these lamps and converters, and it is expected that the lamps will be placed upon the market during the coming summer.



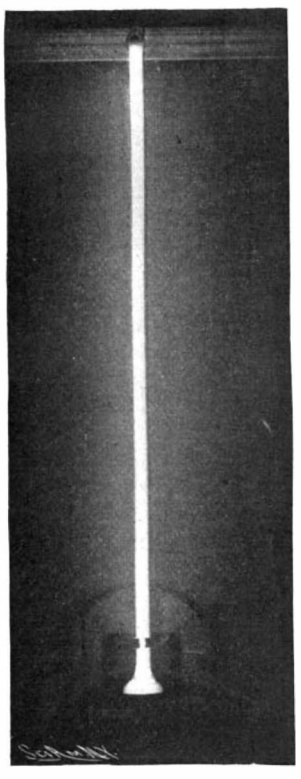
MR. PETER COOPER HEWITT AND LORD KELVIN. A PHOTOGRAPH TAKEN BY THE COOPER HEWITT LAMP.

Natural Gas in England.

BY WILLIAM EDWARD WARD.

At a tiny village in Sussex, less than fifty miles from London, a field of natural gas has been struck which in area and yield promises to be greater than any single American field.

The history of this discovery is a curious commentary on English conservatism. More than a quarter of a century ago, foul air, in a boring sunk by a geological survey, caused an explosion; but the hint passed unheeded. Six years ago need for water was felt at the tiny railroad station of Heathfield, and the company sank a well in search of it. A smell of gas was noticed as the boring was being sunk, but it was vaguely ascribed to "foul air;" until someone applied a match to the borehole, with the result of a burst of flame which was with difficulty extinguished. At a depth of 380 feet the attempt for water was abandoned, but a heavy pressure of gas came from the hole, and this has been constantly used since by the railroad company to light the station. The "marsh gas lamps" proved a source of wonder to the neighborhood, and about twelve months ago local gossip attracted American notice to the curiosity. As the result of intelligent investigation, capital was interested and a company was formed.



THE COOPER HEWITT MERCURY VAPOR LAMP.

At present this company is busily boring day and night, using light and power supplied by gas already tapped; and in the meantime it is reaching out after options and contracts. The possibilities of the field are vast, and the company hopes to control the supply and furnish light and power to the whole of central and southern England. The company has already sunk one well to a depth of 400 feet, and other borings are in progress. At this depth gas is struck at a pressure of 200 pounds to the square inch. As the pressure in the borings steadily increases with the depth, it is probable that a still greater pressure will be obtainable if necessary, though the present one of 200 pounds is sufficient to carry the gas to any large city in England. The capacity of this initial boring is estimated at about fifteen million cubic feet per day; and ten such borings would supply the total requirements of London. An additional ten would suffice for the needs of all the towns on the two principal south of England railroads—both of which traverse the field. The syndicate controlling the field believe that the yield of the first well will prove an average one, and that borings may be increased indefinitely. They are looking forward to a big future.

The investigation of the gas fields by the practical method of boring has been confined to a narrow limit; but the geological indications point to a wide productive area. The strata in which gas occurs are a series of shale beds known locally as Kimmeridge clays, and these underlie a very considerable area in East Sussex. The local theory is that these deep-seated shales are saturated with liquid petroleum, which passes into gas under the pressure-easing advent of a borehole.

Analysis shows the gas to be singularly free from the impurities, such as ammonia and sulphureted hydrogen, which are present in some American yields, It contains 75.5 per cent of marsh gas, 18 per cent of oxygen, 4 per cent of carbon monoxide, and 5.5 per cent of higher hydrocarbons. In this the percentage of higher hydrocarbons is higher than in American gas; with the very practical result that it may be burnt without enrichment, for illumination. As it issues from the well it gives a light only slightly inferior to the not very high standard adopted by the large London gas companies. Used with incandescent mantles it gives a light superior, unit for unit, to coal gas under the same conditions. It has been applied to gas engines with a saving of almost 50 per cent as compared with coal gas, and the change is effected without any adaptation or even special cleaning of the machinery.

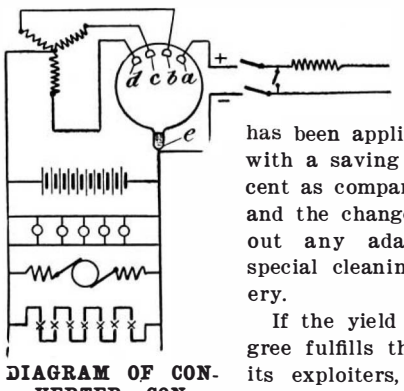
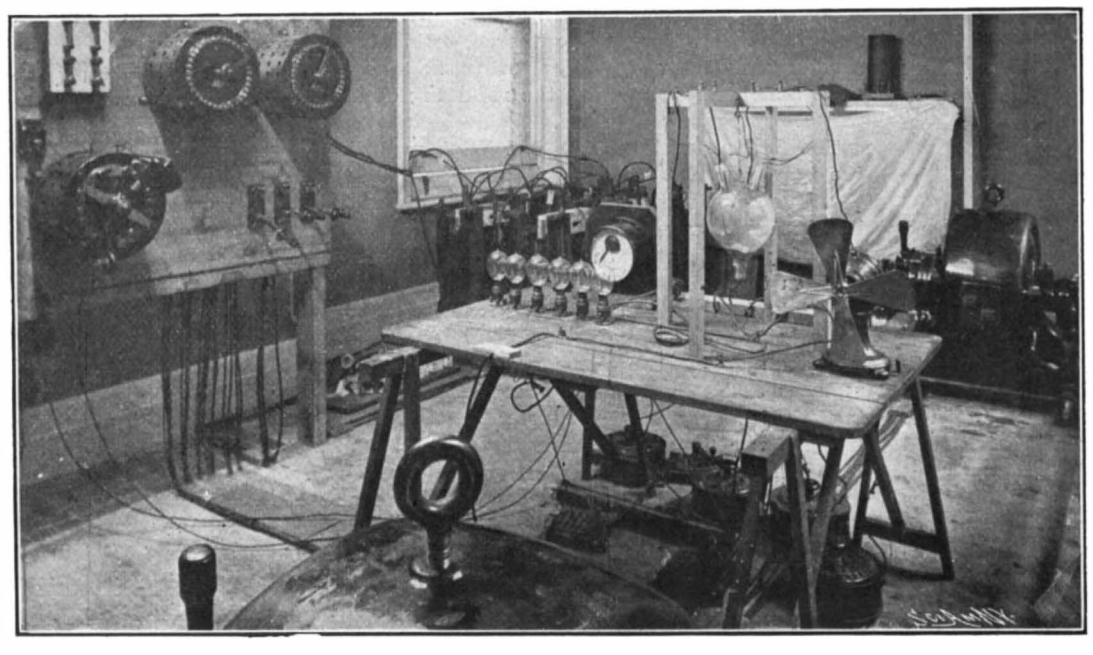


DIAGRAM OF CONVERTER CONNECTIONS.

If the yield of gas in any degree fulfills the expectations of its exploiters, it will soon be available for extensive industrial application. Already the Englishman is beginning to wonder whether natural gas spells pictorial ruin to one of his choicest sylvan counties. Sand of a quality adapted for high-grade glass-making is found in the district; and the first boring pierced a bed of ironstone which in earlier and more primitive days was extensively worked in the neighborhood. But Sussex is not remarkable for its transport facilities, and the ease with which gas can be carried along a pipe-line, together with the fact that factories already exist in other parts of England, will probably result in the supply being carried away to already established centers of industry.

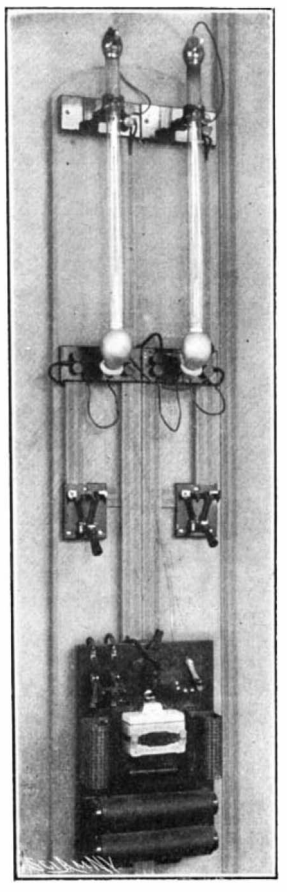
The sentimental aspect of the question is sufficiently strong to bear practical result. Instead of dotting the ground with storage tanks, the company are sinking them underground. A well some 75 feet deep and 15 feet in diameter is sunk, and lined with boiler plates calculated to withstand a high pressure. From the tank thus formed a bore-hole descends to the gas-yielding strata, and from the top of the tank an underground main conducts the gas away. More fortunate even than the much-envied coal lords, the Sussex landowners are looking forward to fat royalties from enterprises so hidden away that they will not permanently disfigure a single foot of ground, nor injure a single head of game.



TESTING APPARATUS OF COOPER HEWITT CONVERTER.

Electrolytic Reduction of Nitric Acid.

In Zeitschr. Anorg. Chem., J. Tafel describes an investigation of the alterations which nitric acid will undergo by electrolysis in the neighborhood of the kathode, considerable amounts of sulphuric or hydrochloric acid being present. A reduction will occur with most kathodes, excepting, for instance, platinum. The mean products of this process are ammonia and hydroxylamine, their ratio depending on a whole series of factors, and varying to a high degree, according to the nature of the kathode, whereas the sulphuric and hydrochloric acids do not seem to exhibit any marked differences. The largest amounts of hydroxylamine are evolved with pure mercury kathodes, or well amalgamated electrodes, the formation of ammonia being almost wholly prevented in some cases, so as to obtain a nearly perfect quantitative transformation of nitric acid into hydroxylamine salt, whereas, in the case of lead kathodes, the amount of the acid transformed into hydroxylamine was not higher than 40 per cent, for copper 15 per cent at the most. The rate of this reduction is smallest in the case of copper electrodes. It is next shown that, with electrodes giving rise to this reduction process, hydroxylamine sulphate will equally be reduced, and *vice versa*. From these facts it is argued that the electrolytic reduction of nitric acid to ammonia at copper kathodes does not pass through hydroxylamine. In order to account for these phenomena, an hypothesis analogous to Chilesotti's interpretation of the effect of the different kathodes on the reduction of nitrobenzol is suggested, certain materials, as, for instance, copper, transforming the reduction process leading from nitric acid to hydroxylamine, by a chemical action, from its essentially electrolytic nature, so as to produce ammonia directly. These experiments tend to show the existence of a specifically electrolytic reduction effect with a given kathode and a given electrode, this effect being in some cases not only quantitatively, but qualitatively, different from the corresponding chemical effect.



MERCURY VAPOR LAMPS AND STARTING COILS.

Last spring Gov. Odell of New York appointed a commission to inquire into the necessity for establishing a State Electrical Laboratory in connection with the Union College of Schenectady. The commission has completed its report, and recommends an appropriation of $275,000 for buildings and electrical equipments. The laboratory is to supply information on questions of electrical science, and an official standard for electrical measuring instruments and apparatus, together with standards for electric wiring of buildings for the protection of municipalities and the general public. Such a laboratory has been established in Germany and has proven a success.

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COWS KILLED IN THUNDERSTORM.

Our illustration shows the result of the pitiable accident which overtook a herd of cows during a thunderstorm near Plainfield, Ill., last fall. It would seem that the unfortunate creatures had drifted toward a wire fence, when the lightning fell upon a tree standing about thirty feet from the fence, causing the death of twenty-eight of them. As there are no signs whatever on the fence of the direct effect of lightning, it must be supposed that the cows killed fell victims to the so-called return stroke. It is well known that persons standing near a conductor occasionally receive a more or less severe electric shock when the lightning strikes some neighboring object. This is readily explained if we remember that just before the lightning occurs, such a conductor must have been at a high electric potential, which is suddenly reduced enormously by the lightning discharge. A person standing near such a conductor, and not adequately insulated, participates in this sudden change, and the effect is evidently the same as if he received a powerful discharge. Fatal cases of this kind have been noted fairly frequently, but it is very doubtful if such extensive loss of life has ever been recorded before as the result of the phenomenon, and we are not surprised to hear the oldest settlers of the district assert that they never heard of so many cows being killed at a time. Fortunately, no human life was lost, and, happily for the owners, the cows were all insured, and no difficulty arose about the payment. The men who removed the hides from the dead cows remarked that dark streaks could be seen under the skin.

Our illustration, which is prepared from a photograph sent us by an inhabitant of Plainfield, gives a rather impressive view of the scene of the accident soon after its occurrence.

TWENTY-EIGHT COWS KILLED IN A THUNDERSTORM, ILLINOIS.

Saving the African Elephant.

The government of the Congo Free State has taken steps to stop the ruthless slaughter of elephants in Central Africa. At the present rate of extermination the elephant will have become an extinct species in the Free State in eight or ten years.

The foreign correspondent of the New York Times states that an agreement was recently reached between the French National Society for the taming of the African elephant, and the government of the Free State, concerning the measures to be taken to domesticate young elephants. All hope therefore has not been abandoned, notwithstanding numerous fruitless attempts to transform the African elephant, like his Asiatic brother, into a precious help to the explorer and the colonist.

The only pity is that the movement for protection of the elephant should have been started so late, when the race has been almost destroyed.

Felix Fuchs, Vice-Governor of the Congo Free State, who is now in Brussels and on the point of returning to the Congo, states that the destruction of the African elephant was due entirely to the development of the ivory trade. M. Fuchs now proposes that an agreement be reached between Belgium, France, Great Britain and Germany to regulate elephant hunting and to encourage the domestication of the animals. Such an agreement, says M. Fuchs, would have strong chances of being crowned with success. Certainly there is no time to be lost if the last remaining remnants of the species are to be saved. But, once thoroughly domesticated, the African elephant would, like his Indian brother, become, thanks to his strength and intelligence, an important auxiliary in the work of colonization.

The Submarine in Warfare.

The French Naval Department has published the report of the various French commanders who participated in the recent submarine boat maneuvers off Cherbourg, in which they succinctly explain what functions the boats can fulfill and their deficiencies.

The commanders state, as a result of their investigations and experiences, that it will be possible for submarines to leave their stations, and that a hostile squadron will never be in safety at moorings situated within the radius of action of submarines. That watches on board ship are of no avail, and artillery fire is ineffective against this arm. The supervision of anchorage, either by means of torpedo boats or torpedo-boat destroyers, is very difficult, and does not really render the vessel secure against submarines. To insure absolute safety to a squadron, it would be necessary to protect the entrance to a harbor by electric wires. For attacking in the open sea, or in rough weather, submersible boats or autonomous submarines of a large pattern must be employed. Torpedoes carried by destroyers would only be a feeble weapon against submarines, because they could only carry a small quantity of explosives, about twenty kilogrammes, and thus the action of the torpedo would be quite limited. A torpedo exploding at a few yards distance from the hull of a submarine would probably do it no damage. In the course of the French maneuvers it was demonstrated that Admiral Makaroff's invention, which comprises a microphonic apparatus, is almost useless. The indications given by it were in every case insufficient. It was also proved that it is perfectly possible to arrange at the entrance to a harbor an instrument indicating changes of position, but it affords little aid to the defense of an anchorage, and absolutely none at all to a vessel at sea.

A New Flashing Lighthouse Light Without Intervals of Darkness.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

During the recent meeting of the British Association at Belfast, a practical demonstration was given of a new and ingenious type of lighthouse light, the characteristic of which is that there are no intervals of darkness between the flashes. In this contrivance, which is the invention of Mr. Wigham, the well-known lighthouse engineer of Dublin, Ireland, the lenses revolve at a given speed so proportioned to the diameter of the illuminant, and the lenticular apparatus, that the light is made to show continually, not as a series of flashes and then a period of darkness, but a continuity of flashes without any intermission or interval of darkness whatever.

The numerous advantages of such a light to a mariner are obvious. A fixed light enables the sailor to take a bearing from it in a way that is not possible under all circumstances with a revolving light, but the result is not satisfactory or reliable with an ordinary fixed light, unless the beam is as powerful as that which proceeds from an annular revolving lens. Heretofore this combination has not been possible to assist the mariner. In looking at a revolving light in order to take his bearing, the sailor has to watch closely the length of time during which, according to the nautical instructions, the light should be invisible, and this exact time is not always easy to ascertain, especially in hazy or rainy weather. Moreover, in observing recurring lights, the beam seldom seems to reappear in the exact position from which it disappeared, owing to the insensible wandering of the eye during the time of darkness, and in thick weather the recurring of the light may be altogether invisible.

The first apparatus which Mr. Wigham devised for the provision of a continuous light was one in which the illuminant was placed in the focus of four lenses, but he has now effected a vast improvement by surrounding the light with eight lenses.

When the light of the illuminant falls upon each of the eight lenses, and the rate of their rotation is sufficiently fast, the flashes follow one another with such rapidity that the impression on the eye of each flash replaces that made by the flash immediately preceding it with definite distinctness; that is, before the impression of the first beam leaves the eye, the second flash without any diminution of power takes its place, and thus the flashes are made continuous, and the light is shown without any interval of darkness. The substituting of one image for the other causes perfectly distinct pulsations, and yet involves no perceptible interval of darkness between the flashes.

It is an incontrovertible fact that the more lights are rendered more distinguishable from one another, the better it is for navigation purposes, owing to the abundance of different lights visible to the mariner, such as lightships, beacon lights, guiding lights to harbors, and so forth. It is imperative that lights of a characteristic appearance should be placed in important positions, so that at a glance they may be seen, and their character and position immediately and easily determined, without incurring any risk of error.

The new Wigham light amply fulfills this condition. It is entirely different from all other lights, being neither a fixed nor a revolving, nor an intermittent, nor an occulting light. As a matter of fact, it is in reality a combination of all these systems, possessing an illuminating power equal to the most powerful, but of so distinctive an appearance as to be at once recognizable from every other light.

Although while in one respect the flashes of the Wigham light are of the nature of lightning flashes, being very rapid and very powerful, yet the apparatus that is used is not of such dimensions as to produce flashes equal in intensity to those from great "feu eclair" lighthouses, such as, for example, Havre and Ushant; but if this light were used in a lighthouse as important as either of the above, it would doubtless be in triform or quadriform, and the power of the light, thus increased threefold or fourfold, would fully equal that due to the action of the larger and more powerful refracting lenses of the "feu eclair;" and while the light would have three or four times the power of an ordinary revolving light, it would have the salient advantage over the "feu eclair," or any other system of revolving lights, that it would have no period of darkness, but would shine continually and *always* present the same appearance to the eye of the mariner, enabling him to take his bearings with great ease and certainty.

In connection with the mechanical revolution of the light, this action of the lenses is not assisted by being placed on rollers and race plates, as is the case in ordinary revolving lights. The friction of such an arrangement would be prohibitory to sufficient rapidity of revolution. Instead, the lenses are mounted on a framing concentrated on a pivot and so balanced on the framing as to be almost entirely free from friction. In the case of triform and quadriform arrangements, the weight of the apparatus is considerable, and to obtain efficient working it would probably be necessary to float the whole apparatus in a mercury cup, so as to reduce the friction to a minimum, as is done in the French "feu eclair" light. The friction being so small, very little power is required to revolve the lenticular apparatus. Its revolution can be effected by a small gas or oil engine, by an electric motor if more convenient, or the weights and clockworks ordinarily used in lighthouses.

An important consideration in all lighthouse lights is cost; but no such consideration is necessary in connection with the Wigham light, since the expense of this light is no greater than that of any other first-class light with revolving annular lenses, and is much less than the "feu eclair" system, which requires for its exhibition specially constructed optical apparatus of a very expensive description. Nor does the question of the cost of the illuminant arise, for any known illuminant may be used, the peculiarity of the appearance of the flashes being due not to the nature of the illuminant, but to the design of the lenticular apparatus and the manner in which it is applied.

Steel Furniture for Warships.

The new cruiser "Baltimore" will be the first warship to be fitted with steel furniture. Naval Constructor Capps and his assistant Constructor Nutting have found that all the essential furniture of a man-of-war can be made of steel. The reason for the use of steel furniture is to be found in the fact that serious damage was done during the war with Spain by the furniture on the ships taking fire.

Some experiments made by H. Schoentjés, of Ghent, with double glazing for windows, which is sometimes adopted with a view to reduce loss of heat, show that there is a certain distance of separation between the glasses at which the heat lost is a minimum. The glass used in his experiments was 2 millimeters (.079 inch) thick, and the loss was least when the distance between the opposing sheets was somewhere between 67 millimeters and 117 millimeters (2.64 inches to 4.61 inches). With double walls at the best distance apart the rate of loss as compared with single walls was about halved.

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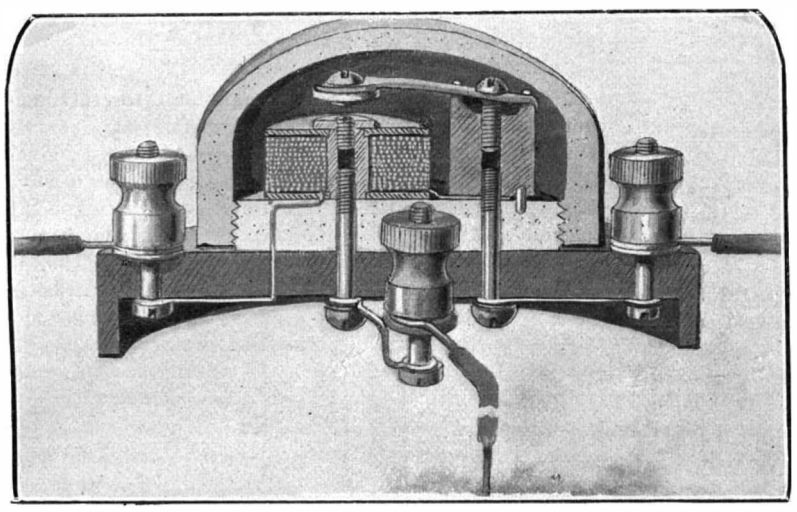
Patent Department

A LIGHTNING ARRESTER OF NEW FORM.

We illustrate herewith a sectional view of a form of lightning arrester recently patented by Mr. Julio E. Cordovez, of Panama, Colombia. It belongs to that



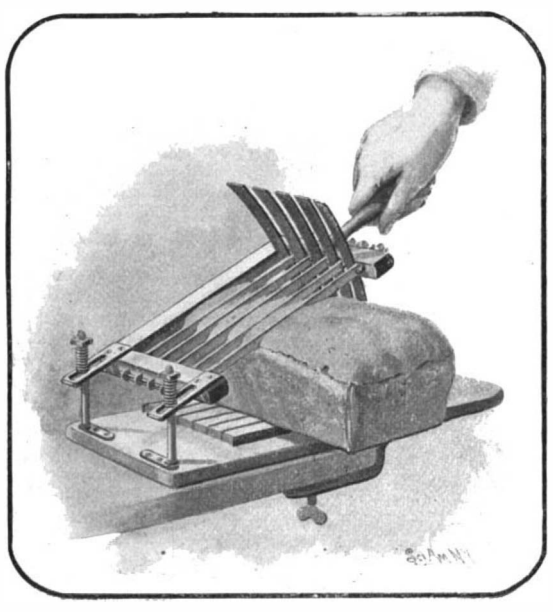
IMPROVED LIGHTNING ARRESTER.

type in which a magnet, when energized by an abnormal flow of current, will attract an armature and produce a ground connection, whereby the flow of lightning or of any undesirable charge of electricity is directed to the earth.

The construction of the device is as follows: Mounted upon a base of hard rubber, or ebonite, is a plate preferably of porcelain. A dome of porcelain covers the device and is screwed down over this base plate. The lightning arrester is introduced into the line by connection to the binding screws at each side. One of these binding screws is connected to the actuating magnet, and from the magnet a wire leads to a metallic post. The line circuit is completed through the screw which holds this post to the base plate and a wire connecting this screw with the binding screw on the right as illustrated. Secured to the top of the metal post is one end of a spring, which supports at its opposite end the armature of the magnet. Side play of this spring is prevented by beads on the post, and the top of the post is also provided with a channel or groove, so that by turning the securing screw the spring is pressed slightly into the channel, thus raising the armature. In this manner the spring can be so adjusted as to hold the armature up against the attraction of the magnet under a normal flow of current. If now a lightning charge strikes either of the line wires, or any atmospheric electrical disturbance causes an increase of potential in the line, the magnet will be sufficiently energized to draw down the armature into engagement with a headless screw in the magnet core. This makes connection through a third binding post to the ground. Further adjustment of the device may be had by turning the headless screw, and securing the same by means of a locking disk as shown.

A NEW SLICER.

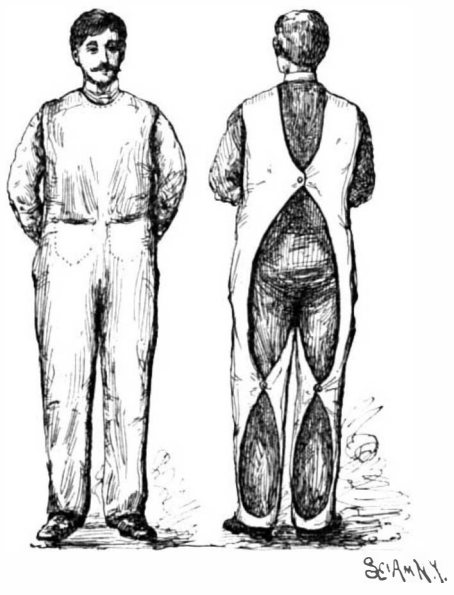
A device of simple construction has recently been invented by Mr. G. L. Leachman, of New Cumberland, W. Va., whereby a number of slices of bread or cake may be cut at one operation. This will be found particularly useful in large restaurants, permitting large quantities of bread to be quickly and easily cut into slices of a uniform size. The device is provided with a clip on its base by means of which it may be readily clamped to a table-top or the like. The slicing blades are held in the frame mounted to swing vertically over the base. The blades at one end pass through slots in the lower crosspiece of the frame, being held there by a rod passing through their projecting ends. At their opposite ends the blades are fastened to threaded stems, which pass through the upper crosspiece of the frame and are adjusted and firmly secured by thumb nuts. On the rear of the frame are two slotted arms through which two posts extending from the base project. On these posts, and bearing down on the arms, are spiral springs which may be regulated to the proper tension by turning the adjusting nuts. Near the forward end of the base are upwardly extending guide fingers between which the cutting blades pass, and on the base in alignment with the guide fingers are strips which are spaced apart and on which the loaf to be sliced is supported. To hold the bread from movement while slicing, pins are employed which extend upward from certain of the strips and enter the loaf. In operation, after raising the frame with the blades, a loaf is placed in the machine against a stop plate and then the frame is moved downward to cut the slices. During this movement the slots in the arms of the frame permit a slight longitudinal movement of the blades through the bread, and the springs on the rear posts have a tendency to force the rear ends of the blades downward. The spaces between the strips on the base permit the blades to pass effectually through the loaf.



BREAD CUTTER.

A NEW PATTERN FOR OVERALLS.

A patent has just been granted to Mr. Eugene A. Holston, of Duluth, Minn., for a new form of overalls which can be quickly applied, allow perfect ease of movement

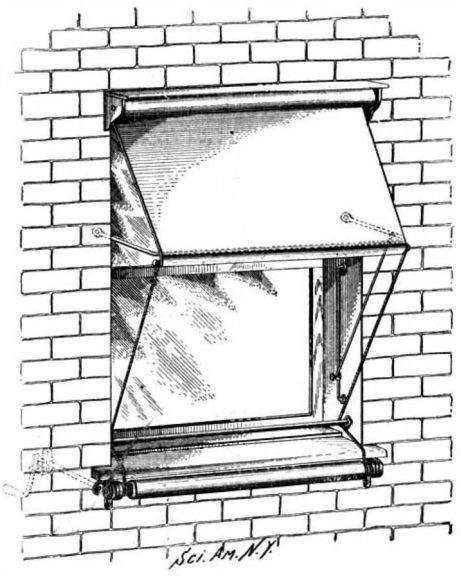


A NEW DESIGN IN OVERALLS.

to the wearer, and prevent crumpling of trousers over which this improved garment is worn. The garment, as illustrated, covers completely the front of the body and legs. It is held in place by portions passing over the shoulders and by flaps attached which extend around the back of the trunk and legs of the wearer. The garment is snug fitting over the trunk, but fits loosely over the legs. Owing to the fact that the rear portions of the knees and hips are not covered, perfect freedom of movement is allowed at these points, and since the garment fits loosely over the lower portions it allows the trousers beneath to hang properly and does not crumple or gather them in bunches. The readiness with which this improved overall can be slipped on over the ordinary trousers and buttoned in place is a feature which should appeal to all workmen.

ODDITIES IN INVENTIONS

CONVERTIBLE WINDOW-SHADE AND AWNING.—A recent patent describes an improved arrangement of window-shades whereby the shade may be easily converted into an awning or be made to serve as a substitute for shutters to the windows. The shade, which is made of any translucent flexible material capable of withstanding the elements, is secured to a spring-roller of ordinary type, journaled under a cover to the upper outside of the window-frame. Operating cords are secured to the lower end of the shade and pass over a projecting awning-frame, thence under a rod at the bottom of the window to the lower winding roll. This roll may be operated, through the medium of a pair of miter gears and crank, from the interior of the building. By this means the shade may be drawn down as illustrated to serve as an awning. The operating crank, it will be observed, is hinged so that it



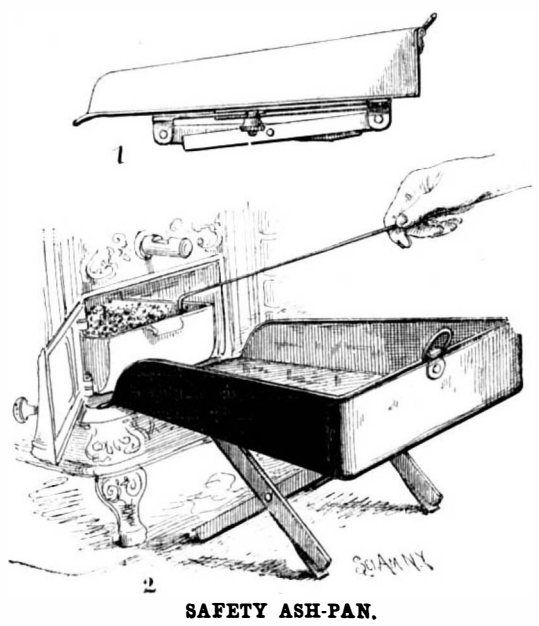
CONVERTIBLE WINDOW-SHADE AND AWNING.

may be folded back to engage a catch and thus hold the curtain in position against the tension of the spring roller. By drawing the shade down to its limit the room will be shaded and sheltered from outside observation. At the same time an ample sufficiency of light will pass through the translucent material, and a generous supply of air will be admitted through the openings at each side of the curtain. This arrangement also serves to prevent frost from accumulating on the window-glass at night. It will be observed that the awning-frame may be adjusted to various positions, or may be folded flat against the window-frame.

DEVICE FOR WARMING BRIDLE BITS.—In cold weather the bits of bridles hung up in a stable often become so cold as to torture and seriously injure the horses when these cold bits are placed in their mouths. We show here a very simple device for warming the bits. It consists of a cap piece adapted to fit over the top of an ordinary barn lantern. This cap is provided with two curved guards, which serve to engage the bits and prevent them from slipping off. Our illustration shows a bridle hung by its bit to the cap piece and being warmed by the heat of a lantern. Grooves are provided in the top of the cap piece for receiving the bits, and two bridle bits may be warmed at the same time without interfering with each other.

DEVICE FOR WARMING BRIDLE BITS.

SAFETY ASH-PAN.—One of the most irksome duties connected with a range is the removal of ashes. There is always the danger of spilling some of the ashes while endeavoring to lift the inaccessible pan out of the stove, and raising a cloud of dust; nor should we ignore the danger of dropping live coals or sparks on



SAFETY ASH-PAN.

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the floor and thereby causing a fire. The operation would be greatly facilitated by the employment of a safety pan, such as that illustrated, into which the stove ash-pan may be drawn to a more accessible position, and then easily removed. This safety pan is provided with folding legs, so that it may be properly supported when in use, and at other times folded as in Fig. 1 to occupy a minimum space. The legs, it will be observed, are pivoted together at their centers and to the pan at their upper ends; but the forward upper pivot is adjustable toward and from the rear upper pivot, being secured to a bar sliding in a guideway. A thumb-nut is provided, which may be screwed up to secure the bar in any desired position. The height of the pan from the floor can thus be regulated to a nicety. The lower ends of the adjustable legs are provided with lugs, to prevent the legs from reaching and passing the center, which would lock them and render it impossible to adjust the legs by means of a slide.

United States Patents in 1902.

The annual report of Mr. F. T. Allen, Commissioner of Patents, for the calendar year ending December 31, 1902, has been forwarded to Congress. It appears that during the twelve months its statements embrace there were 48,320 applications for patents filed in the Patent Office, 1,170 applications for design patents, 151 applications for a reissue of patents, 2,602 applications for registration of trade marks and 1,121 applications for registration of labels. On these applications there were 27,776 patents issued, including designs; 110 patents reissued, 2,006 trade marks registered, 767 labels and 158 prints. The number of patents that expired was 23,331. The number of allowed applications awaiting the payment of the final fees was 9,284. The number that were forfeited by non-payment of fees was 4,471. The total expenditures of the office were $1,393,345.54. The excess of receipts over expenditures was $159,513.54, and the total balance to the credit of the Patent Office in the treasury of the United States was $5,488,984.61.

More patents were issued to citizens of the District of Columbia in proportion to population than any other State or Territory in the United States, the ratio here being 1 to every 1,080 of the population.

The Patent Office issued 27,886 patents during the year 1902, the largest annual issue in its entire history.

The number of mechanical patents issued during the year 1902 is 27,136, exceeding by 1,578 the issue of such patents for the preceding year, which was then the largest number issued by this office in any year.

In the work of handling this business it should be noticed that the class of mechanical patents, which has increased so largely in numbers during the last year, comprises those cases which involve the largest amount of work in their consideration. The increase of work indicated by the figures given has been met in some degree by the increase in the number of examiners which was provided in the appropriation bill for the year 1902-'03.

The work of classification of patents has progressed satisfactorily during the past year, and the results of this valuable system are now available to facilitate the examination of the question of novelty of inventions.

The duties of the assignment division of this office are to record assignments of patents and inventions and to furnish manuscript copies of records of the office when required. During the year 1902, 24,091 deeds were received for record, of which 22,833 were recorded. Copies of records were also made, which included 16,576,150 words. The number of deeds received was 1,102 in excess of the number for the preceding year, and the number of words written in furnishing copies of records was 2,056,110 more than for the preceding year. These figures serve to indicate the rapid growth of this portion of the work of this office.

During the last year Section 4883 of the Revised Statutes was amended by act of Congress, approved April 11, 1902, the change making it no longer necessary that patents should be signed by the Assistant Secretary of the Interior.

Another Patent Dedicated to the Public.

Following the example of Col. J. J. Astor, who, it will be remembered, recently presented his turbine patents to the public in a letter addressed to the Editor of the Scientific American, Brig.-Gen. William Crozier, Chief of the Bureau of Ordnance of the War Department, dedicates to the public in a letter to the Commissioner of Patents, his invention of certain improvements in wire-wound guns. Gen. Crozier has taken this step in order that inventors who desire still further to improve on the gun may have the opportunity to use his invention as the basis of their work. In his letter he says that:

"A feature of my invention consists in the manner of so locking together the parts of the gun that they cannot separate in a longitudinal direction under the action of the forces to which the gun is subjected, at the same time interrupting in a very slight degree the continuity of the wire envelope."

Brief Notes Concerning Patents.

Mrs. Sarah Wood Clarke, of New York, is the inventor of a device which is said to greatly increase and improve the sound of the piano. There was recently given a demonstration of the improvement at one of the leading hotel ballrooms of New York. The device is a shell-shaped construction placed inside the lid of a grand piano, and when this is opened as usual for a performance the shell acts as an auxiliary sounding board, improving the tone of the instrument and increasing its volume.

A. A. Phipps, who is the inventor of a self-heating branding iron, has just returned to his home in Denver, Col., after a trip through all the principal countries of Europe in the interests of his invention. Although this method of branding was introduced only a short time ago, it is now being widely adopted through the West. The device consists of a copper brand on the end of a steel tube. The latter acts as a reservoir for gasoline, which is turned into gas and burned inside the branding metal, which is thereby kept hot constantly. The self-heating branding iron is now patented in fourteen countries.

A paper improvement is announced from Chicago, by which the strength of the paper is greatly increased. This process was worked out by Dr. John Weisner and Adolph Gehrman, both of the Columbian Laboratory. The latter was until recently the City Chemist connected with the Health Department. The process is not ready to be announced, but Dr. Weisner says they have gone far enough to say positively that they have discovered a formula by which the strength of all paper can be increased four or five times by the addition of some chemicals while the paper stock is in the course of manipulation.

The manufacture of lightning rods has declined to such an extent that the business has almost been lost sight of. There appears to be no mention of it in the census reports, there being no reports of any output of this character made by any electrical manufactory, and only one firm of electrical engineers announces the design of lightning rods as a part of their business. Lightning strokes are reported to be more rare, especially in the cities where there are such an abundance of electrical wires which serve to protect the surrounding properties.

Miss Ida May Fuller has brought suit for infringement against Messrs. Gilmore & Thompson, of the New York Academy of Music, and Frank McKee, manager of the "Ninety and Nine" Company, which filled a date at that house recently. The alleged infringement consisted of the use of a device by which the flames are realistically imitated by the use of widths of silk, moved by the action of a rotary fan, the illusion being heightened by the colored rays from a limelight. One of the thrilling scenes of this performance is the passage of an engine through the leaping flames, going to the assistance of some fire-stricken pioneers.

Mention has been made here before of the process invented by the artist J. F. Raffaelli, now in Paris, who has devised a means of solidifying colors so that superior effects can be secured without the use of the palette and brush. It is also stated that the new method has the advantage of rapidity. An exhibition of seventy-two works of various character, done by twenty different artists, was held recently at the Durand-Ruel gallery in Paris and attracted a great deal of attention, not only because of the novel method by which they were made but because of the excellence of the results attained.

A hollow axle for railroad cars is being made by the Howard Axle Company, of West Homestead, Pa., which concern is controlled by the Carnegie Company. For the purpose of fully determining the value of this innovation, the axles are being fitted to one of the pressed steel cars of the latest design, which after six months of service will be examined and compared with another car, fitted with the solid axle, which has been in the same service. The axle is made under the Merrader patent and the advantages claimed for it are less weight, lower cost, and greater service. The manufacture of the hollow axle is a much simpler operation than that of the solid axle.

A new steam yacht in New York waters is the "Revolution," which was built at the works of the Charles L. Seabury Company, at Morris Heights, to demonstrate the adaptability of steam turbines to commercial marine purposes. The engines are the design of Charles C. Curtis, and the boat is 178 feet over all, 16½ feet beam and 7 feet draught. While the boat was not built for speed, she has shown herself to be one of the fastest crafts in the waters around New York. The "Arrow" of Charles R. Flint, which has a reputed speed of 39 knots an hour, barely beat her in a three hours' run, and the turbine boat pulled all around the "Monmouth." which is said to be the "Arrow's" second.

RECENTLY PATENTED INVENTIONS.

Electrical Inventions.

VISIBLE-SIGNAL TELEGRAPH.—W. A. Farrell, Wellsville, N. Y. In this visible-signal telegraph the object of the invention is to form letters of the alphabet and similar characters by simultaneously flashing a plurality of lights arbitrarily selected from different clusters for the purpose of forming the characters of a prearranged alphabet. The main features of the apparatus consist of a switchboard provided with switches for operating an electric current and a series of lights, preferably nine in number, arranged in distinct clusters, each cluster being made up of lights of different color and the several clusters being alike.

ELECTRIC MOTOR OR GENERATOR.—J. A. Titzel, Sr., Franklin, Penn. This electrical device belongs to the class capable of use either as motor or generator, and the inventor has for his object the production of a strong and uniform magnetic field, so that the apparatus will be throughly efficient in either of its capacities. This application is a division of another one previously filed by Mr. Titzel.

ELECTRIC CUT-OUT.—C. Wagner, Brooklyn, N. Y. This invention bears on improvements in electric cut-outs particularly adapted for use in connection with the wiring of electric lamps; and the aim is to furnish a cut-out of simple construction designed for connection with a lamp-supporting tube or standard, through which the wires pass and arranged to have a rotary movement in one direction to cut the current in or out.

Engineering Improvements.

APPARATUS FOR CONTROLLING THE PASSAGE OF STEAM OR WATER.—E. M. Eden, No. 76 Adelaide Road, London, England. This contrivance has for its object to provide in connection with a steam-boiler, steam-trap, or other steam-container, valve-operating means whereby to cause a valve controlling the passage or escape of steam or water to be automatically operated for the purpose of regulating directly or indirectly the action of a feed pump or injector, also for permitting the escape of water from a steam-trap, or for allowing the passage of steam to a whistle in the case of a high or low water alarm, the action of the valve-operating device being dependent on difference or equality of pressures established within the device, according as the temperature of the contents differs or not from the temperature of steam at the pressure within the steam-container with which it may be connected, whatever that pressure may be.

Mechanical Devices.

FARRIERY-MACHINE.—S. J. McDonald, Gallatin, Mo. The primary object of this farriery machine is the provision of means by which either a plain-toed shoe or a clip-toed shoe may be produced in an easy and quick manner. It answers the demand among farriers for a simple, strong, and compact machine which will hold a horse or mule shoe in a position convenient to the workman in finishing up any portion of a horseshoe, either the plain-toed shoe or the shoe having a toe-clip, and also to finish an outwardly standing calk at the toe of the shoe, as well as the heel.

SAFETY APPLIANCE FOR DUMB-WAITERS.—H. Donohoe, New York, N. Y. The purpose of this invention is to prevent the falling of a waiter in case of breakage of the hoisting cable. When the weight of the dumb-waiter is thrown upon the free end of the lever, the end is moved upward, thereby compressing a spring. With the lever in this position, whether the waiter is raised or lowered, the spring is usually compressed. If, however, the hoisting-cable breaks, the elasticity of the spring asserts itself, the lever's long or free end is instantly thrown down, and a revoluble roller engages the lever, thereby pressing the shoe into contact with the stationary cable, thus locking the waiter upon the cable.

MACHINE FOR MAKING PIPE-MOLDS.—J. Ingham, J. Poulson, and J. W. Moore, Phillipsburg, N. J. The improvements developed by this invention relate to a machine for making pipe-molds of plastic material, such as sand combined with a suitable adhesive substance; and it involves a vertically disposed flask and pattern with a number of stamps arranged to work between them. The particular improvement within the scope of this invention, is the manner of feeding the material and of driving the stamps.

Technological Advances.

CONCENTRATED HOPPED WORT AND PROCESS OF PRODUCING SAME.—H. A. Hobson, 54 Church Road, Acton, London, England. In this process the inventor secures the production of a hopped wort from which beer, either alcoholic or non-alcoholic, may be made by the mere addition of yeast and water or of water alone, as the case may be. In the ordinary brewing process, at times the bitter of the hop is unfavorably affected, objectionable resinous matters are extracted, and the volatile aroma of the hops to a great extent lost. In the present invention these defects are avoided.

MULTICOLOR-PRINTING.—E. T. Neben, East Orange, N. J. The present invention relates to multicolor-printing by engravings or otherwise. It provides the face of a metallic plate with projections, and forms thereon by a photographic-printing process any design or transfer print or drawing of the object to be treated in color, and stains the print to render it visible, then forms non-printing portions in the plate by cutting out such portions, and also forms graduated and solid printing portions on the plate, by burnishing the portions.

SILVER BROMID GELATIN AND PROCESS OF MAKING SAME.—A. Cobenzl, Bingen-on-the-Rhine, Germany. In this process all the difficulties in making a sensitive silver bromid gelatin which does not cloud are avoided, and a product always without failure is obtained in an easily-washable form. The product possesses an even degree of sensitiveness and all desirable qualities. The gelatin is manufactured by subjecting a solution of the emulson in a hot state to the action of alcohol. It is then permitted to ripen, then to cool by agitation so that the gelatin precipitates as a fine-grained sandy powder, which is finally separated and washed.

PROCESS OF SOLIDIFYING VOLATILE HYDROCARBONS AND ALCOHOL AND PRODUCTS THEREOF.—A. H. Cronemeyer, New York, N. Y. The aim of this invention is to offer new means of solidifying inflammable hydrocarbons in order to obtain a congealed product which when ignited will burn without melting the body of the product and without danger of explosion. The process in question is chiefly applicable to the solidification of

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alcohol, naphtha, benzol, benzin and **gasoline**: and consists in adding sodium hydrate, wood-alcohol, stearin and resin (colophony) to the hydrocarbon to be solidified. The product can be handled, packed, shipped and used with absolute safety.

Railway Improvements.

RAILROAD CROSSING.—E. J. O'NEILL, Ada, Ohio. Mr. O'Neill's invention is an improvement in railroad crossings, having for an object to provide a simple construction whereby there is furnished a continuous track in one or the other direction of the crossing, by means of swinging rail sections and by which the swinging rail sections are locked in their different adjustments. The invention dispenses with breaks in the rails at the crossing, and thus avoids the blows of the wheels, which result in much damage, not only to the rails and wheels, but to other portions of the cars.

Vehicles.

MEANS FOR LOCKING THE STEERING MECHANISM OF MOTOR-VEHICLES.—E. DEVLIN, Paterson, N. J. The invention of Mr. Devlin pertains to improvements in means for locking the steering-gear of motor-driven vehicles of any kind, and this design is adapted for use in connection with the steering-gear of such vehicles as automobiles, locomobiles, and wagons or carriages of any description used for pleasure or business purposes, and which may be propelled by electrical energy, steam, gas, gasoline, or any other agent or motive power. The essentially new feature of the contrivance is a device for locking and holding with positive certainty the steering gear against turning accidentally.

Miscellaneous.

CAN-OPENER.—JAMES M. NETTLES, Shubuta, Miss. This implement will readily and easily open oyster, sardine, and other tin cans. It is claimed for the device that it is entirely different from any other can opener, both in the manner of its construction and its use, there being no danger of cutting the hand with the can opener or the tin while in operation.

EGG-TESTER.—J. CARLEN, Havana, N. D. An improved device for testing eggs has been invented by Mr. Carlen. The device comprises a tray, a casing therein adapted to receive the lamp, a dark chamber at one side of the casing, and a sight tube leading into this dark chamber. Means are provided for carrying the eggs through the dark chamber where they are examined through the sight tube.

WORT-COOLER.—A ZIGER, Brooklyn, N. Y. An apparatus for cooling wort as it comes from the kettles in the brewery is provided by this invention. It embodies certain novel features of construction, which enable it to be used not only as a wort-cooler, but also as a strainer to remove the hops from the wort, thus permitting the wort to be run directly from the cooler into the fermenting room, and dispensing with the necessity of the "hopper jack" which has heretofore been used.

DRY-COMPOUND FIRE-EXTINGUISHING TUBE.—A. and T. R. HOPPER, Highland, N. Y. The tube or receptacle is so constructed that it will not allow the compound to fall in large masses and thus exert but little influence on the fire, but which, through the action of the hand in throwing the material from the tube in conjunction with a diffusing device at the mouth of the tube, will produce a large quantity of well-diffused powder resulting in a greater generation of fire-extinguishing gas.

SPRINKLER-HEAD.—J. K. S. RAY and W. D. MCNEILL, Whitmire, S. C. The invention relates to fire extinguishers arranged to release a valve having thermal-action at a predetermined temperature. The sprinkler head is so constructed as to insure a free flow of water whenever the fusible brace is melted and even in case the valve should stick at one point owing to undue corrosion, sediment, or other causes.

INDICATOR DEVICE FOR DRIP-PANS.—F. E. WIESNER, Washington, D. C. Mr. Wiesner's invention is an improvement in the indicating devices for drip pans, designed especially for use in connection with refrigerators, and by which to indicate the height of water in the drip pan at one side of the refrigerator.

CAR-REPLACER. — A. R. BATCHELDER, Portsmouth, N. H. In the embodiment of this improved car replacer two members of peculiar construction and connected by a special hinged joint are employed. One member rests upon, and is locked to the track; the other serves to guide the car wheel from its derailed position back to the track rail.

GARMENT-SUPPORTER.—L. WERTHEIM, New York, N. Y. This improvement relates to a hose-supporter which is suspended from the waist of the user. The object of the invention is to supply an effective supporter which may be very quickly applied and removed and which will also serve somewhat the purposes of an abdominal pad. When once in position the device will securely support the garment.

FLOATING FISH-TRAP.—A. C. BURDICK, Seattle, Wash. This invention provides a floating fish-trap adapted especially to be towed or drawn by steamers or like vessels. The trap is so constructed that a single heart only is used in connection with the pot, which heart extends over the seine. The pot is yieldingly supported upon scows or like floats in such a manner that the rocking of the scows by action of waves will not have any harmful influence upon the proper equilibrium of the pot. The invention also provides means whereby independent inlets are obtained over the seine, one at each side of the heart, and a pocket in connection with each inlet, the pockets and inlets serving to direct fish through the heart and into the pot. By inclining the bottom of the pot and its supports from the rear upwardly and forwardly the pot and supports will ride the current and waves, and not tow under.

TEMPLE AND SPRING-CLAMP FOR LENSES OR THE LIKE.—E. L. LEMBKE, New York, N. Y. The object of the present invention is to provide a new and better temple and spring-clamp for spectacles and eyeglasses which is simple and durable in construction, cheap to manufacture, and arranged for convenient, quick, and secure attachment to or removal from the lens without requiring apertures and bolts, pins, or similar fastening devices. The clamps on eye-glasses are fixed so that they take up little room at the sides of the lenses, and are not in the least unsightly or cumbersome.

TRUCK-WAGON.—E. H. TYLER, New York, N. Y. The improvement in this new contrivance relates to truck-wagons—that is, wagons used for hauling building materials, safes, barrels, boxes, freight, etc., and which are provided with depending trucks upon which materials are to be loaded. All objects which it is desired to handle practically on the ground, may be readily loaded into a truck, even when the wagon is at another place. As the trucks are flat and rest on the ground, goods can be loaded, practically on the ground. No skids or bridges are necessary, and no merchandise can be broken or injured while loading or unloading.

WATCH-PROTECTOR.—D. SUMMA, New York, N. Y. This contrivance relates to watch-protectors—that is, to devices for preventing the loss of a watch by theft or otherwise while worn upon the person. In using this invention, the chain is threaded through the ring and placed in the pocket in the usual manner. Should the chain be violently drawn by any means, the watch is lifted upward to a certain extent in the pocket, but remains therein because of the ring. The tension of the chain upon this ring causes the device to be raised slightly, and this movement imbeds the teeth in the cloth of the pocket. The harder the chain is pulled the more tightly will the teeth bite into the cloth, thereby drawing the owner's attention.

SKIRT AND WAIST HOLDER.—M. DISTELMAN, New York, N. Y. This patent refers to a skirt and waist holder for women's garments; and one object the inventor has in view is the provision of a simple and cheap article which is adapted to hold the lower portion of a dress-waist from pulling up and away from the dress-skirt and, further, the provision of an article which may be drawn and held tightly over the abdomen to secure the appearance or effect known as a "straight front," and a final object to provide means associated with the article for holding the skirt in proper place and against any tendency to drop at the rear portion.

TAILPIECE AND BRIDGE FOR ZITHERS.—F. REINHARD, Jersey City, N. J. The purpose of the inventor is to so construct a tailpiece for zithers and like musical instruments that the bridge may be combined with the tailpiece, and, further, to provide the tailpiece with tongues adapted to receive the loops of the strings, which tongues are in the same plane with the surface from which they are struck out, the material around the tongues being pressed inward in conical form. Thus the loops of the strings when placed upon the tongues are protected, and prevented from opening, pins are done away with, space is saved, and the tone of the instrument is improved.

CANOPY-SUPPORT.—J. MUGFUR, Aspen, Col. The improvement in this patent is on canopies for use on bedsteads, lounges, tables, or the like, or for application to vehicles, or on lawns. The canopy may be made of any suitable size, and can be used horizontally on lawns, beds, tables, carriages, or elsewhere, and when desired for shelter from the sun on lawns, it can be arranged vertically.

TALLY DEVICE.—L. L. FROST, Highland, Kan. This tally device is adapted for use in connection with check-books or with account-books, although it may be used generally in the addition or subtraction of figures. The object in view is the provision of a simple and efficient device by which the value of a given amount may be readily increased or diminished by the addition or subtraction of different amounts, such as constantly arise in commercial or business transactions. An increase in the value of the given amount can be quickly found by addition of a certain amount: but when a check is drawn against the bank account the device will indicate the amount charged against the account and the balance remaining to the credit of the depositor, thus denoting a decrease in the value of the original deposit.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

LABORATORY EXERCISES IN PHYSICS. By George R. Twiss, B.Sc. New York and London: Macmillan Company. 1902. Pp. xiii, 193. Price 80 cents.

The experiments are selected and the directions written with regard to three purposes—first, to secure the thorough enforcement of some of the fundamental principles of the science, together with a view of the kind of thinking and experimentation by means of which the facts and principles of physics have been established; second, to develop habits of precision in observation, thought, and expression; and third, to train the student in the acquisition of practical power and skill in the use of apparatus. It must be acknowledged that Mr. Twiss has arranged his chapters in an ideally simple form. Each exercise begins with a clear and concise statement of its purpose. In drawing his inferences and reaching his conclusions the student is aided by directions which clear the path for him to a certain extent.

UNTERSUCHUNGEN AUS DEM HYGIENISCHEN INSTITUT IN GRONINGEN. VERSUCH EINER NEUEN BAKTERIENLEHRE. Von Dr. A. P. Fokker, Haag. 1902. Pp. 49.

THE FERN BULLETIN. A Quarterly Devoted to Ferns. By George E. Davenport. Binghamton, N. Y. 1902. Pp. 97-128.

THE NEW INTERNATIONAL ENCYCLOPEDIA. Daniel Coyt Gilman, LL. D., Harry Thurston Peck, Ph.D., L.H.D., and Frank Moore Colby, M.A., Editors. Vols. I. to VI. New York: Dodd, Mead & Co. 1902.

In the exceedingly brief space of this review, it is manifestly impossible to discuss with any degree of fullness so ambitious an undertaking as the publication of a new encyclopedia. That such a work has long been needed by the man who is at all familiar with the scientific matter contained in the encyclopedias that are now placed at his disposal, is evident enough when it is considered that the encyclopedias which make any pretense at scientific discussion are antiquated. A new encyclopedia should therefore be particularly strong in its treatment of scientific subjects; for in science, both pure and applied, the world has made its greatest strides within the last quarter of a century. We have, therefore, confined our attention to an examination of those portions of the six volumes which lie before us which deal more particularly with science. If the article on chemistry is to be considered a fair example of what this new work has to offer us, it cannot be denied that it supplies much that is wanting in other encyclopedias. In the twenty-one pages comprising the article in question, there will be found a very systematic presentation of the subject both from its philosophical, as well as from its more practical standpoint. Probably a discussion of radio-active compounds is to be included in the article on physics; for in no other way can we account for their omission here. Not the least commendable feature of the International Encyclopedia's method of discussing scientific subjects is the annexation of an excellent bibliography to each important article. The list of books on chemistry, for example, contains what may well be considered leading works by leading authors. The mathematical portions of the Encyclopedia seem exceptionally complete. As examples we may mention the discussion of the differential and integral calculus and of co-ordinates. The treatment of analytical geometry and conic sections, although fairly adequate, might have been somewhat fuller. An examination of the articles on engineering subjects shows that the editors have seen to it that both in mechanical and civil engineering the International Encyclopedia has adequately considered modern improvements. The treatment of bridges is particularly full. The illustrations, moreover, have been aptly selected, including as they do the typical arch bridge over the Niagara River, the typical cantilever bridge at Poughkeepsie and the steel truss bridge over the Delaware River. A picture of a suspension bridge might well have been inserted. We are glad to note that illustrations of rolling lift bridges also find a place in the article, perhaps for the first time in any encyclopedia. The author of the article on caloric engines has done his work well. His discussion includes what may well be considered the best types of hot air engines and is strictly modern in its treatment. We are glad to note that electrical subjects have been treated with the thoroughness that they deserve. On dynamo-electric machinery a very full article appears, which is both accurate in its presentation and illustrated by well-known modern types of machines. The article on electricity is good. The many cross references indicate that the later features of the subject, such as wireless telegraphy and the like, have not been neglected. Even the newer forms of lamps, such as the Nernst lamp and the vacuum tubes of Tesla and Cooper Hewitt, find a place in the sixth volume. A word or two on the general appearance of the book may not be out of place. To the matter of typography and illustrations the publishers have given exceptional care. The diagrams are clear, and the half-tone plates uncommonly good.

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Notes and Queries.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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(8815) W. H. T. asks: How is gas made from water? Is there a book that would enable a foundry foreman to learn how to make an analysis of the iron in his castings? A. Briefly described, water gas is produced by blowing steam through a layer of brightly glowing coal; the water is decomposed, and the coal is consumed; the gases coming off are a mixture of hydrogen, carbon monoxide, and hydrocarbons, with small amount of carbonic dioxide, and variable amount of nitrogen. When the coal cools off too far to further decompose the water vapor, this is shut off, and air is blown through until the coal again burns brightly and is ready for more steam. While the air is blown in, the gases are allowed to escape up the chimney, as they have no value as illuminant, and in fact would not burn at all. The water gas as it comes from the producer has very little illuminating power. This is imparted to it by enriching with benzine.—There is no book which would explain to anyone not a chemist how to determine the amount of iron in brass or other castings. Such work must be done by a chemist. All books on analytical chemistry of the metals describe methods for this, but would be unintelligible to any person except a regular chemist.

(8816) R. G. P. asks: Are there any chime music boxes with a set of bells on them? How does the name chime get its name? A. The word chime comes from a Latin word, meaning bell, and also cymbal. Music boxes are made with sets of bells in them.

(8817) E. G. P. asks: How can a scratch be removed from the top of an oak table (highly polished)? A. If the scratch is only a slight, superficial one, it can usually be removed by rubbing with a rag soaked with crude oil. If a deep scratch, it will be best to rub down the whole top of the table with powdered pumice and crude oil, and then revarnish.

(8818) G. P. O. wishes a process for galvanizing such as is done on the base boards for stoves. A. The article to be galvanized is first thoroughly cleaned by dipping in weak muriatic or sulphuric acid, and is then thoroughly dried. After this it is plunged in a bath of molten zinc, wherein it becomes coated with a layer of zinc, being what is known as galvanized. The surface of the molten zinc must be kept clean by sprinkling with powdered sal ammoniac and skimming off the dross from time to time.

(8819) G. G. G. asks: How can I gild or mottle edges of books, to resemble as nearly as possible those gilded by publishers? A. To gild the edges of books, they are first trimmed smooth, then sized with egg albumen (white of egg) and gold leaf then applied. When dry it is burnished with agate burnisher. For mottling, a very thin solution of gum arabic is prepared in a tray, and the different colors are then shaken in or combed in. A half dozen or so of the books are held securely and evenly together, and the top, bottom and front edges are successively dipped in lightly, and the excess of color is each time blown off. Successful mottling is quite expert work.

(8820) W. J. D. asks: 1. Is there any method by which soft coal can be made into brick or lump form by mixing with other substances or by itself. A. The powdered or crushed soft coal can be pressed into bricks and then be partially coked to give strength. If the coal alone will not adhere sufficiently well on pressure, it can be mixed with pitch, and then partially coked. 2. Can the ordinary 150 deg. test kerosene oil be clarified to prevent the strong smell while burning in a lamp or wick oil stove? A. A good quality of kerosene will not give much odor in burning in a lamp or wick oil stove, if care be taken to keep the wick well trimmed, and to adjust so that it will burn without smoke. There is no way of further purifying kerosene oil, as to make it burn without odor.

(8821) P. C. asks: We have a dynamo of 110 volts and 25 amperes. I want about 20 pieces of good red-hot wire 1 inch long and no matter how thick, for special use. I intend to make them hot from the above-mentioned dynamo. Can you inform me what is the best

(Continued on page 103.)

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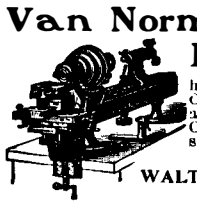

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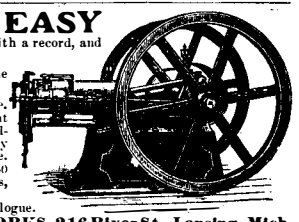

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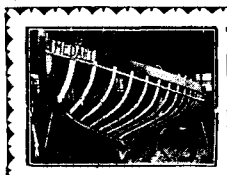

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material to make the wire from to keep hot for days and months? A. Platinum is the only material which can withstand red heat for any length of time without being destroyed by oxidation.

(8822) E. L. C. asks: 1. If a vessel sinks in five miles of water, will she go to the bottom? If not, why? I think she will; the others think not. A. If a vessel begins to sink, it must continue to sink till it reaches the bottom. If it is compressed by the pressure of the water as it goes down deeper and deeper, it becomes still heavier with reference to the water than it was at the surface, and at the surface it was heavy enough to sink. At greater depths it will be able to sink faster, since the water is not compressed to any extent at greater depths than it is near the surface. If anything can sink at all in water, it will go to the bottom before it stops. 2. If a man gets into a tank of water resting upon a pair of scales, and floats upon the water, will the scales register the man's exact weight in addition to the weight of the tank and water? Will it make any difference whether he floats or lets himself sink? The tank sides are high enough, so that no water can overflow. A. The balances will show the weight of the man in addition to the weight of the tank and the water. When the man gets into the water, the water rises in the tank; that is, it becomes deeper. It is exactly the same as if more water were poured into the tank. No one would doubt that the scales would show more weight if 100 pounds of water were put into the tank. Why not when 100 pounds of man are put in. This question has traveled for a century in various forms around the world.

(8823) S. B. M. asks: Will you kindly settle the following arguments? Practically the same principle is involved in all three, and of course the velocity of the cannon ball in the first is absurdly small, but that is granted for the sake of the argument. 1. A train is running east ward at a speed of 100 miles an hour. Mounted on the front of this train is a cannon. From the cannon is fired a projectile with a velocity of one hundred miles an hour westward; i.e., in a direction opposite to the motion of the train. A holds: 1. That the projectile will move over the top of the train with a velocity of 100 miles an hour. 2. That its velocity with regard to the ground is nil; i.e., through space it has no velocity. 3. That a rifle ball will reach the ground in just as short a length of time when fired at a high velocity as if it were dropped from the muzzle of the gun with no lateral velocity, granted of course that the ground is level and the bore of the gun is parallel to the ground. B holds: 1. That the projectile will move over the top of the train at the rate of 200 miles an hour. 2. That with regard to the ground it has a velocity of 100 miles an hour westward. 3. That this is not true. A. In your various propositions regarding relative motion, the one whom you designate as A is right and B is wrong. Such problems are applications of Newton's Three Laws of Motion, or rather of the first and second laws. These laws are to be found in all school textbooks of physics. The cannon mounted upon the train which is running 100 miles an hour is carried eastward by the train with a velocity of 100 miles an hour, and sends its projectile westward with a velocity of 100 miles an hour. It should be plain that a ball which moves east and at the same time west with the same velocity will be at rest with reference to the earth below it. The train moves away under it. The ball would drop vertically upon the roof of the train, or upon the earth below from the muzzle of the gun, if the train could run from under it before it had time to fall upon the roof. The rifle ball shot horizontally will fall toward the ground as really and with the same velocity as if it were dropped vertically. See Newton's Second Law. Gravitation produces its effect, whether it acts at the some time with other forces or acts alone. This is the reason why a ball which is projected upward returns to the earth again. All objects not supported fall toward the center of the earth in exactly the same manner, since gravity produces its effect upon all alike. It matters not how they are moving under the action of other forces. II. An elevator falls down a shaft at the rate of 50 feet per minute; a man drops after it at the rate of 60 feet per minute. A holds that the man will strike the elevator with the same force as if the elevator were stationary and he were dropping 10 feet per minute. B holds that he will strike it with less force. A. A man who strikes an elevator which is moving ten feet per minute slower than he moves will strike it with a velocity of ten feet per minute, and give a blow proportional to his weight and his velocity. III. The same thing as II. (a) A train is moving at the rate of 30 miles an hour; on the same track a train is following at 40 miles an hour; (b) they are moving at the same speeds on parallel tracks. A holds that (a) the second train will strike the first with the same velocity or force as though the first were standing still and the second struck it going at the rate of 10 miles an hour; (b) that the second train will pass the first at the rate of 10 miles an hour—will take as long to pass it as though it were standing still and the second

(Continued on page 104)

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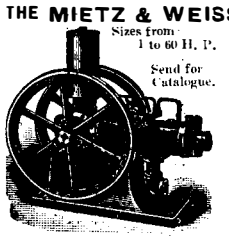

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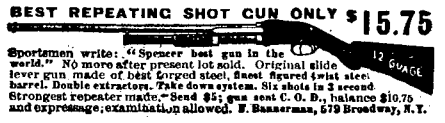

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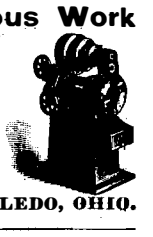

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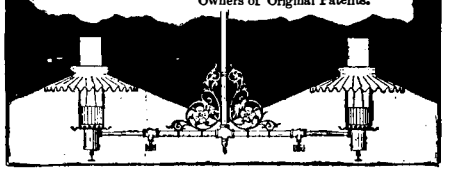

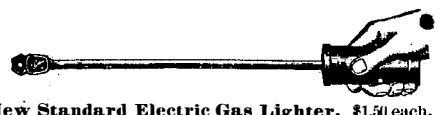

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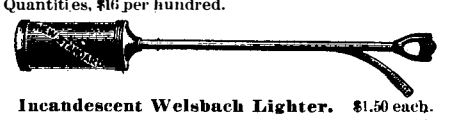

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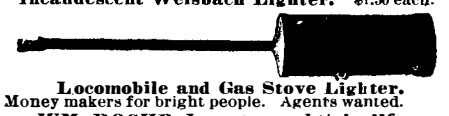

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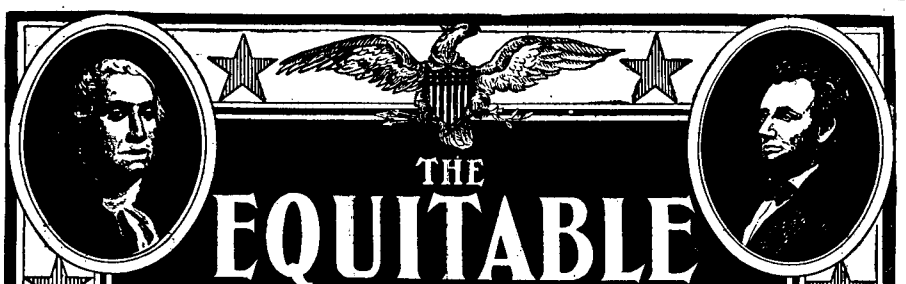

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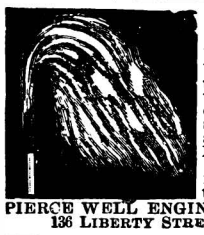

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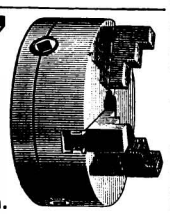

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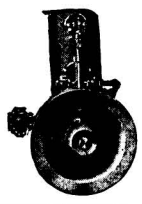

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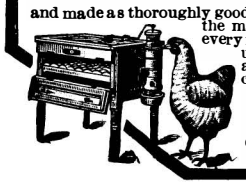

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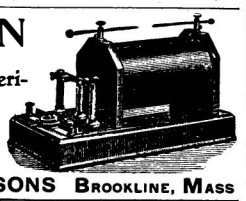

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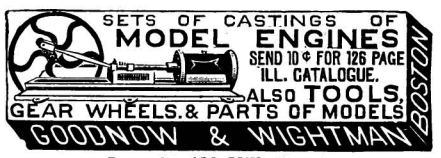

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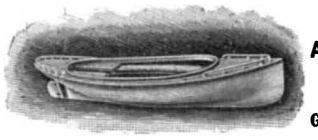

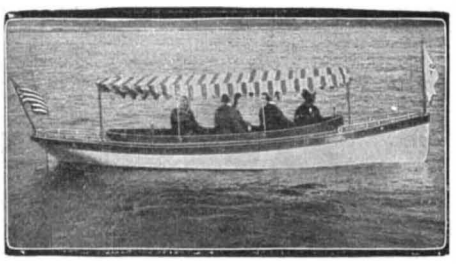

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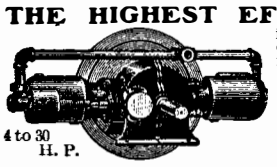

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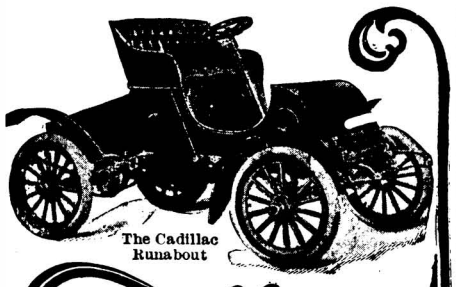
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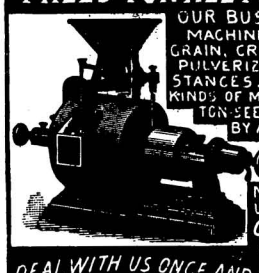

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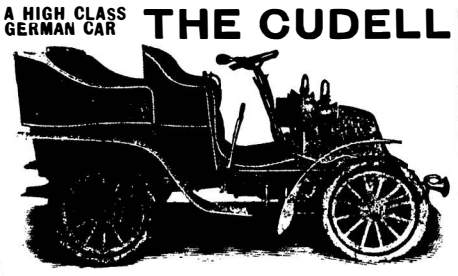

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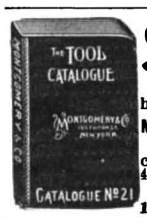

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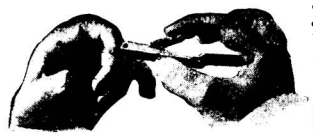

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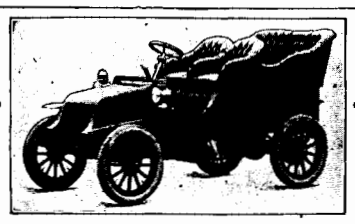

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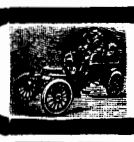

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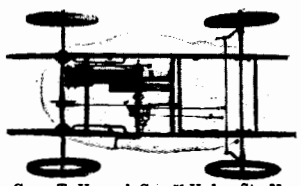

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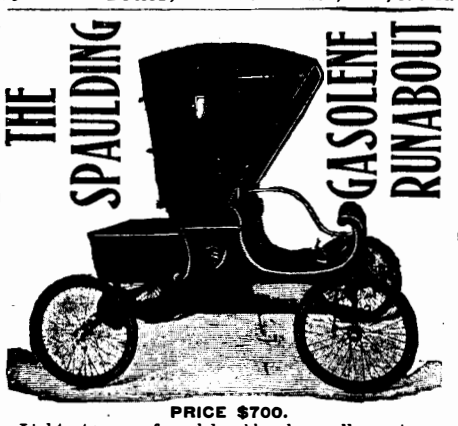

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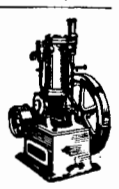

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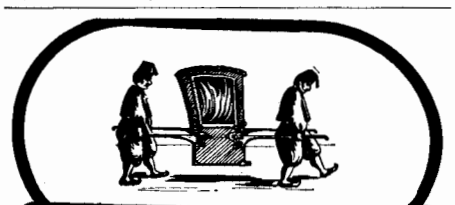

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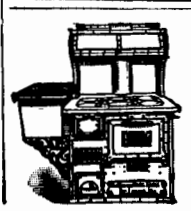

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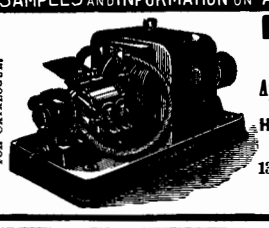

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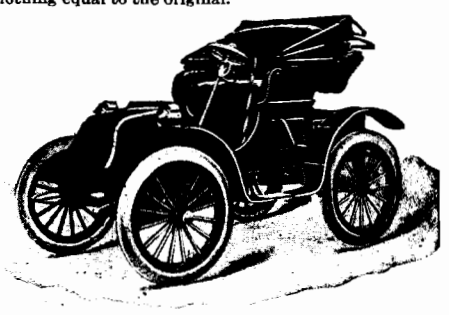

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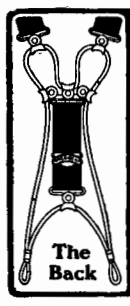

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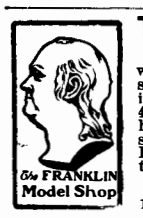

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